Renewable Energy Transmission Initiative

RETI Coordinating Committee

PHASE 2A

DRAFT REPORT

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1.0 Executive Summary

1.1 Introduction: About RETI and this Report

The Renewable Energy Transmission Initiative (RETI) is a California stakeholder process charged with developing a plan for expanding the state's electric transmission grid to provide access to renewable energy resource areas necessary to meet state energy goals. This plan is intended to help expedite development and approval of renewable energy infrastructure found to be required, in ways that minimize the economic cost, environmental impacts and number of new transmission facilities. To this end, RETI estimates of the amount of renewable energy to be delivered in the period to 2020 assume full achievement of energy efficiency program targets and aggressive, continuing expansion of distributed photovoltaic generation beyond currently adopted state goals.

RETI work is organized into three phases:

Phase 1: Identification and ranking of Competitive Renewable Energy Zones (CREZ) in California and neighboring regions;

Phase 2: Development of a statewide conceptual transmission plan to access priority CREZ, based on more detailed analysis of CREZ;

Phase 3: Development of detailed plans of service for priority components of the statewide transmission plan.

RETI work is directed by a Stakeholder Steering Committee (SSC), and performed largely by working groups composed of volunteers representing a wide range of interests and perspectives. RETI is committed to ensuring that its process is open and transparent, and that recommendations are based on the best publicly available information. Stakeholders focus as well on communicating RETI goals, process, results, and recommendations to a larger public audience.[1]

Phase 1 work is summarized in two reports available, along with all materials, maps and meeting records, on the RETI website.[2] In addition to the RETI mission statement, Phase 2 activities are guided by Executive Order S-14-08, issued by Governor Schwarzenegger on November 17, 2008.

[1] Background information about the purpose and formation of RETI, its Mission Statement, SSC member contact information and all RETI documents are available at www.energy.ca.gov/reti.
[2] Renewable Energy Transmission Initiative, Phase 1A Final Report, May 16, 2008; Renewable Energy Transmission Initiative, Phase 1B Final Report, January 2, 2009. See also, RETI Phase 1B Final Report Update, February 24, 2009.

RETI Phase 2 work focuses on two major tasks:

1. More detailed evaluation and re-ranking of CREZ preliminarily described in Phase 1;
2. Development of a statewide conceptual transmission expansion plan to access the CREZ.

This report presents the results of these activities and the processes used to obtain them. It is divided into chapters on each major task.

One of the primary functions of this report is to provide a recommendation as to which potential transmission projects should be considered priorities for future study, based upon information available today regarding the potential for renewable development. This report does not preclude study of other areas with potential renewable development nor is it a determination of the need for or environmental impact of any generation or transmission project. Results of the study should be considered in the context of the uncertainty of the potential cost and amount of renewable generation that will actually develop in specific CREZ. These assumptions, and the uncertainties surrounding them, are detailed in the RETI Phase 1B Report.

The conceptual transmission plan presented here evaluates the relative usefulness of potential lines for accessing and delivering renewable energy, under a limited set of assumptions. It does not provide information about the amount of energy that would flow in the line segments if they were in fact added to the system. It does not address congestion, reliability or other dynamics of transmission system operation. And it does not determine whether or to what extent the existing system could accommodate those flows if the line segments were *not* in place.

With limitations of the preliminary conceptual plan understood, this report presents two noteworthy conclusions: stakeholder consensus recommendation of two sets of major lines likely to be required not only to deliver renewable energy, but that would provide important additional benefits to the grid; and development of a transparent and objective methodology for evaluating the usefulness of lines to carry renewables, in a process that supports active participation by a broad range of stakeholders.

1.2 Revised CREZ Descriptions

Phase 2 work has revised the descriptions and adjusted the boundaries of several CREZ initially identified in Phase 1. These changes incorporate new information from many sources, including on-the-ground evaluation of permitting and project developability issues. Revised CREZ provide a more accurate basis for estimating the

electricity generation potential of biomass, geothermal, solar or wind projects sited in those areas. The timing and scale of actual generating projects that may be developed, however, remains uncertain.

1.2.1 CREZ Revision Working Group

Phase 1 CREZ descriptions were based on information available in mid-2008. In many cases, this information was preliminary or incomplete. In addition, reviewers of the Phase 1B report raised a number of issues which could not be addressed in that report. One major Phase 2 task was to update and revise Phase 1 CREZ descriptions as appropriate.

The SSC formed a CREZ Revision Working Group (CRWG) to perform this task. It is chaired by the co-chairs of the Environmental Working Group (EWG), and meets regularly by web conference and frequently in person. CEC staff continues to provide invaluable support to the group.

1.2.2 Limitations of CREZ Environmental Screening

CREZ mapping revolves around identifying areas in which biomass, geothermal, solar and wind generating projects can be most feasibly developed, considering resource quality, environmental concerns, proximity to existing transmission, distance to load centers, and capability of surrounding land uses to support this development. CREZ identification includes high-level environmental screening that: 1) excludes certain areas from consideration as development sites, based on statutory or policy restrictions; and 2) indicates areas where energy development may create fewer environmental concerns, based on the best information available to the Environmental Working Group (EWG).

EWG evaluation cannot, and is not intended to represent the magnitude of environmental concern or impacts of projects which may be developed within a CREZ. Numerical ratings are intended only to indicate relative levels of concern and have been used for the limited purpose of comparing CREZs. Because these values are gross indicators of potential environmental concern rather than of actual environmental impacts, they should not be used for any other purpose.[3] Given the limited focus of CREZ identification, it is possible that renewable energy development in any CREZ could result in significant environmental impacts under the California Environmental

[3] As reported in Phase 1B, consensus could not be reached on how wind project footprint, in particular, should be defined and applied in assessing environmental effects. The wind industry takes strong exception to the formulas applied in RETI environmental ranking, pointing to the lack of data and systematic study of such impacts, and stresses that they should not be considered to establish a precedent for evaluating wind project impacts.

Quality Act (CEQA), the National Environmental Policy Act (NEPA), or result in permit and mitigation requirements under either the California or federal Endangered Species Acts or other statutes.

1.2.3 Revised CREZ Descriptions and Re-Ranking

In addition to environmental considerations, Phase 1 CREZ descriptions were drawn to include both proposed commercial projects (referred to as "pre-identified projects") and "proxy" projects. Pre-identified projects were defined as those having a Power Purchase Agreement, a position in a transmission owner's interconnection queue, site control or a BLM lease application. Proxy projects, by contrast, had no identified commercial sponsor; they were identified only as sites that could be developed to take advantage of high quality renewable energy resources.

The viability or "developability" of proxy projects represented a major uncertainty associated with Phase 1 CREZ descriptions. The large majority of these were potential solar projects, many of which were located on private lands. During the Phase 1 process, no information was available on the degree of parcel and ownership fragmentation of the private land underlying these proxy projects. That data has now been accumulated and analyzed for all the CREZ in Southern California. At the recommendation of solar generators and other stakeholders, proxy solar projects in areas having more than 20 different owners per two-square mile area were deemed unlikely to be developed. Those projects were removed from CREZ, and new proxy projects were placed in feasible locations that met the ownership criteria. As a result, descriptions of some CREZ have changed significantly in Phase 2, especially in the Western Mojave area where large amounts of land remain extensively subdivided under abandoned land-use plans. Descriptions of some CREZ were also altered to eliminate proxy projects erroneously located in RETI Phase 1 on lands donated by The Wildlands Conservancy to the federal government. In Phase 2, all proxy projects on Wildlands Conservancy lands have been removed from RETI maps.

In addition, the list of generation projects in which commercial interest has been expressed ("pre-identified" projects) has been updated based on information from the Bureau of Land Management, the California Energy Commission, California ISO, and publicly-owned utilities (POUs). More precise locations and descriptions of many of these projects are now available and have been used in the CREZ adjustment process.

The CRWG developed a matrix of potential issues to serve as a checklist for identifying environmental issues of concern in each CREZ. This environmental issues matrix does not provide a single quantitative score for CREZ re-ranking. Rather, the

matrix was designed to provide quantitative and qualitative information useful in estimating the difficulty and rate of generation project development in CREZ and thus the timing of future transmission needs. These matrices survey a broad spectrum of issues, but are not exhaustive. County concerns and detailed local information, for example, remain largely unavailable, and the CRWG could not incorporate these concerns into the CREZ re-ranking process.

After re-evaluating CREZ located in Southern California, the CRWG revised the descriptions of several of them to account for new information about permitting and developability. The revised CREZ descriptions have been used to re-rank the CREZ based on economic and environmental factors using the same process described in the Phase 1 B report.[4] A bubble chart showing the revised CREZ assessment in terms of the relative economic cost and environmental concerns per unit energy produced is presented in Chapter 2. Economic and environmental evaluation of revised CREZ remains subject to the same limitations noted in the Phase 1B Report, and CREZ economic scores remain subject to the same uncertainties as explained in that report and in Section 2.3 below.

1.2.4 Out of State Resources

RETI has focused primarily on in-state renewable resource potential. Consideration of renewable resource regions located out of state in Phase 1 was limited by lack of comparable environmental data. Despite concerted efforts to obtain such information, data required to assess out of state areas on a basis comparable to that used for California CREZ remains unavailable.

Because of the need to evaluate potential imports of renewable generation from neighboring states in Phase 2 conceptual transmission planning, resources from British Columbia, Oregon, Nevada, and Baja California have been treated as CREZ. The relative economic scores of resources in these areas were computed on the same basis as California CREZ. In the absence of sufficient environmental data, Phase 2 work groups assigned the median environmental score for California CREZ to each of the out of state areas.

In Phase 1, Black & Veatch evaluated the economics of potential of wind and solar *projects* in California, whereas for out of state regions they evaluated only the development potential of resource areas. (They evaluated biomass and geothermal resources on a project-level basis both in-state and out of state). For Baja California, they considered wind resources only in the border region; Rocky Mountain resources were not considered at all. Efforts to obtain a more detailed assessment of the economic potential

of out of state resource are underway. The SSC will consider using revised estimates of cost-competitive resources from out of state areas in future RETI work, if they can be well-enough documented to provide a basis for supplanting those used in Phase 1.

1.2.5 Proposed Mojave Desert National Monument

The Mojave Desert National Monument contemplated by California Senator Dianne Feinstein would affect at least a few CREZ, if in fact it is created by legislation. Monument boundaries have not been established, but very roughly the area that has been talked about runs from Needles, CA to the vicinity of the Pisgah Substation, and from north of the northeast boundary of Joshua Tree National Park to the southern border of Mojave National Preserve. Establishment of a monument including this general area would eliminate approximately 11,700 MW of potential solar and wind generation in the Pisgah, Iron Mountain, Baker and Needles CREZ.

Because of the uncertainty surrounding creation of the monument and its boundaries, RETI has not modified the energy and environmental scores of the potentially affected CREZ in its Phase 2 work. With the assistance of the EWG, however, some transmission line segments were changed to avoid the area potentially affected by the monument. The remaining transmission line segments necessary to access generation in these CREZ were evaluated and rated by the environmental expert panel.

RETI will follow plans for creation of the monument closely and modify CREZ designations and supporting transmission facilities as appropriate.

1.3 Conceptual Transmission Plan

The initial transmission expansion plan presented in this report represents the consensus recommendation of a diverse set of stakeholders on a set of major upgrades of the California grid, referred to here as Renewable Foundation lines and Renewable Delivery lines. These facilities increase the capacity of the grid, allowing energy to flow north or south as needed, and deliver energy to load centers. RETI does not have the capability to determine the extent to which the existing grid can accommodate new sources of renewable generation. However, these lines are likely to be required, given the amount of renewable energy required to meet state goals in 2020. Importantly, they are also are likely to be needed to meet growing energy demand regardless of generation source. Lines likely to be used no matter how the future unfolds—how population grows,

[4] The Executive Summary of the RETI Phase 1B Final Report describes CREZ ranking processes.

energy efficiency savings accrue and generation develops—are referred to as least-regrets upgrades. They are so named because decision-makers who approve, and the customers who pay for, such infrastructure are unlikely to regret doing so. Identifying this set of least-regrets upgrades is a major outcome of RETI Phase 2 work.

In addition to Renewable Foundation lines and Renewable Delivery lines, the plan includes groups of Renewable Collector lines which provide access to geographically-adjacent CREZ. These groups, and the line segments of which they are comprised, are discussed in Chapter 3, and detailed in Appendices F and G.

This plan has been developed using a transparent and objective methodology for evaluating conceptual transmission connections that combines renewable energy access and environmental considerations. This methodology supports an unprecedented level of stakeholder involvement in conceptual planning geared specifically to evaluate transmission for renewable energy. It has the significant limitations explained in Chapter 3. But at a time when national and regional transmission planning is increasingly being tied to renewable energy development, stakeholder involvement in planning will help build public acceptance of the required infrastructure. Development of this ranking methodology is a second significant outcome of Phase 2.

1.3.1 Purpose and Limitations of Conceptual Transmission Planning

As population grows and Load-Serving Entity (LSE) energy supply portfolios change, new transmission facilities are likely to be needed to maintain system reliability and deliver electric generation—including increasing amounts of renewable energy—to customers. The purpose of conceptual planning is to identify such potential transmission facilities for detailed study. Power flow modeling and production cost simulations performed by the CAISO and POUs then determine which projects are needed and make economic sense, and how they must be configured electrically. A plan capable of being implemented can be developed only after such detailed study.

The RETI SSC recommends components of the plan presented here for such study. These components are conceptual only. They represent potential network connections between substations.[5] Most of the conceptual geographic routings for these line segments are located in existing transmission rights of way or designated corridors or parallel existing transmission line rights of way. Precise geographic routings, however, cannot be determined at the conceptual planning stage.

[5] Network connections are lines in which power flows in both directions.

1.3.1.1 An Objective Approach to Conceptual Planning

Conceptual planning is normally done by experts who have detailed knowledge of the operational characteristics of individual transmission systems. These experts use their judgment to identify potential upgrades or new facilities for detailed study. Because it relies on expert knowledge and is judgment-based, this process is rarely transparent, and it has been difficult to incorporate stakeholder perspectives at the conceptual planning stage in ways that build broad support for transmission expansion.

One goal of RETI, however, is precisely to involve stakeholders in conceptualizing how large amounts of renewable energy can best be delivered to customers, in order to ensure that transmission expansion plans fully consider the interests of all those constituencies who may be affected by, and whose support will be needed to support the approval of new infrastructure.

To this end, RETI has developed a new, objective methodology for assessing the usefulness of potential transmission facilities for the purpose of delivering economically competitive and environmentally preferred renewable energy. Planning began with the renewable energy requirements of California LSEs in 2020 and was designed to ensure sufficient transmission capacity to satisfy those requirements. The methodology incorporates revised CREZ energy, economic and environmental information first assembled in Phase 1, approximately 200 potential network transmission elements including over 100 line segments, their estimated cost, electrical performance and environmental attributes.

The amount of quantitative detail considered in developing and assessing the RETI conceptual plan is unusually extensive. This conceptual plan will continue to evolve as information is updated and improved, analytical methods are refined, and the renewable energy industry grows. The RETI renewable transmission planning assessment methodology offers a model for other transmission planning efforts getting underway throughout the US.

1.3.2 Conceptual Plan Development and Assessment

1.3.2.1 Conceptual Transmission Planning Work Group

The SSC formed a Conceptual Planning Working Group (CPWG) to develop a statewide conceptual transmission expansion plan. Work Group members include representatives of all major transmission providers, Load-Serving Entities (LSEs), regulatory and permitting agencies, renewable energy generators, environmental organizations, and other stakeholders. The Work Group met bi-weekly beginning in

October 2008; from January 2009 on, it then met weekly, in person and via web conference.

The SSC specified major assumptions the Work Group was to use in developing this plan in a Phase 2 Guidance Document. These directed that the plan should: 1) provide access for approximately 100,000 GWh/year of renewable energy (160% of the target for new renewable energy in 2020); 2) include some level of access to all CREZ; and 3) provide for import of approximately 15,000 GWh/year of renewable energy from out of state resources. The SSC also directed the CPWG to assume that only 40% of the energy output potential of each CREZ would actually be developed by 2020.[6,7] To further limit the amount of new transmission facilities found necessary, CPWG planning also assumed that wind generation (much of which occurs during nights and evenings) and solar generation located in the same region could share the same transmission capacity.

1.3.2.2 Plan Development and Assessment

Using its collective judgment, the CPWG first assembled a comprehensive list of potential network line segments having sufficient capacity to provide access to all CREZ and cost-effective out of state resource areas, and to allow delivery of renewable energy to all LSEs adequate to meet their policy goals. These conceptual connections between substations were mapped to understand their proximity to areas having known land use restrictions or other environmental sensitivities. Segments found to be in conflict with these restrictions were reconfigured or eliminated from consideration.

Many of the line segments proposed are already in various stages of planning by various transmission owners. This prompted considerable debate over whether facilities in advanced stages of planning should automatically be included in the conceptual plan without further assessment of their renewable energy attributes. In order to identify the most effective ways to access renewable energy on a consistent basis across all transmission owner systems statewide, the SSC decided that the RETI conceptual plan should evaluate the renewable energy attributes of all proposed transmission facilities which have not yet received permission to be constructed.

To this end, the CPWG developed a methodology to evaluate the electrical function of each proposed line segment in relation to its value in: 1) providing access to

[6] On-going work indicates that less than 40% of the output of each CREZ may be required to meet the state's 33% RPS goal, and this conceptual planning target may be revised downward, to 35% or less.
[7] Phase 2 planning assumes that 100% of the potential energy output of Tehachapi wind and Imperial Valley geothermal resources will be developed, along with 100% of the Out of State resource potential (Baja, Nevada, Oregon/Washington, British Columbia) found to be economic in Phase 1.

renewable energy resources in California and neighboring states; 2) enabling energy transfers between major load centers; and 3) delivering energy to those loads. Standardized investment cost data was developed for all proposed facilities. In addition, the EWG developed a methodology, summarized below, for evaluating potential environmental concerns likely to be associated with construction of proposed facilities.

A complete set of renewable energy, cost, and environmental data was prepared for each proposed line segment. Individual segments were then combined into functional groups, and the line segment information was combined to provide information for each group. The complete assessment methodology is shown schematically in the flow chart in Figure 1-1.

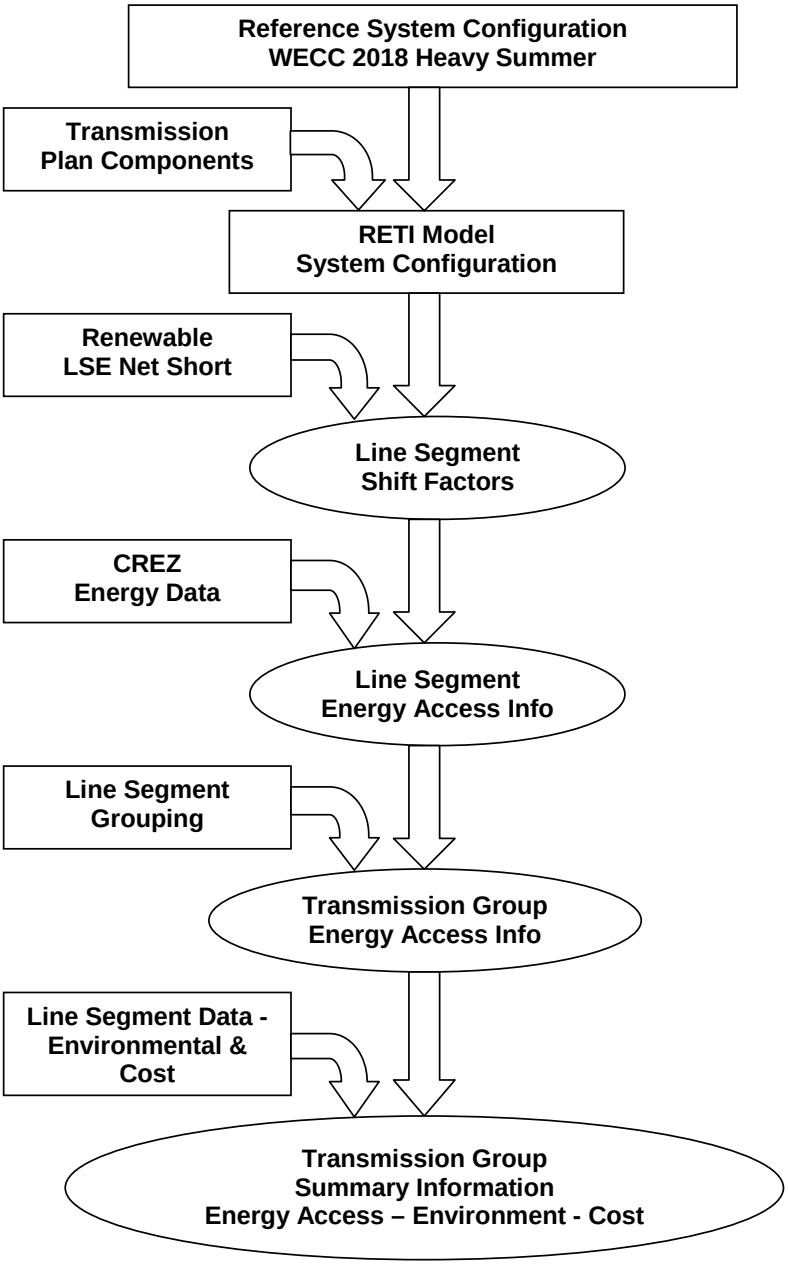

Figure 1-1. Conceptual Plan Assessment Flow Chart.

The conceptual plan assessment methodology follows a five-step process:

1. Transmission system modeling – In the first step, all of the proposed new network transmission elements in the plan were added to the western regional transmission system expected by the Western Electricity Coordinating Council (WECC) to be in place for the year 2018.

2. Shift Factor Calculations – This transmission system configuration, with the proposed new network facilities added, was analyzed for RETI by San Diego Gas & Electric Company using the ABB GridView computer program. The program injects a small amount of energy from each RETI CREZ, one at a time, and withdraws this energy at LSE load centers, in proportion to each LSE's net short estimates. The program calculates the fraction of these small energy injections which would flow in every segment of the WECC grid, including the proposed RETI line segments. These fractions are known as "power distribution factors" or "shift factors." They provide the basic information on the energy from each CREZ which flows in each line segment of the conceptual plan.
3. The shift factors were then combined with four different sets of energy information associated with each CREZ to provide a renewable energy rating for each line segment. The four rating criteria employed capture the economic and environmental score of each CREZ, as revised in Phase 2; the energy output of each CREZ; and commercial interest, represented by the amount of energy able to be provided by projects having Power Purchase Agreements and/or queue positions in each CREZ.
4. The line segments were then combined into functional groups, with line segment information combined to provide overall results for each group.
5. Environmental ratings and investment cost for each line segment were also compiled for each group, alongside group energy ratings. This information is summarized for comparison purposes on Table 1-1 below.

1.3.2.3 Environmental Framework of the Conceptual Plan

Conceptual planning usually considers only potential electrical connections between substations, without regard to geographic factors. The first steps in the RETI planning approach, in contrast, are to exclude even potential transmission facilities (referred to as "conceptual" facilities) from being considered on lands where development is prohibited by law or policy, and to avoid environmentally sensitive lands. RETI Phase 1 work referred to these as Category 1 (Black) and Category 2 (Yellow) lands, respectively.

As emphasized in the discussion of CREZ revision work, RETI review of environmental concerns associated with generation and transmission projects is necessarily limited to high-level screening. Nevertheless, the SSC believes that even preliminary assessments of environmental concerns associated with new transmission

facilities can help evaluate the developability of line segments. This includes identifying those unlikely to be able to be permitted.

The CPWG, CRWG and EWG, working together, modified the configuration of several of the transmission components initially proposed for the statewide plan, to avoid sensitive areas and to make maximum use of existing and approved corridors. Interested stakeholders frequently attended collaborative working sessions.

In addition to this initial environmental screening process, the CPWG and CRWG developed a methodology to quantify the level of environmental concern associated with every line segment. This considers the amount and type of new rights of way required and the extent of disturbance associated with construction of new facilities. In addition to these objective considerations, the CRWG convened panels of environmental experts, for Northern California and Southern California, to provide their collective professional opinion on environmental concerns and the extent to which these concerns could be mitigated. Line segment environmental data, the issues matrix used by the expert panels and panel members can be found online at http://www.energy.ca.gov/reti.

1.3.2.4 Updating the Conceptual Plan

The conceptual plan described in this Report is a work in progress. It identifies conceptual connections capable of delivering much more renewable energy than the RETI planning target of 160% of the estimated renewable net short. Future RETI work will prioritize and narrow down the number of line segments. The current plan includes line segments likely to be redundant, so some will be reconsidered; others may be added. CREZ data continues to be updated as more information becomes available on out of state resources, land use managers amend their plans, and renewable development patterns change. Assessment results will continue to be updated so that mid-course corrections can be made in the future.

Despite the limitations inherent in CREZ and transmission element data and assessment methodology, the current plan provides a stakeholder-vetted basis for detailed planning by the CAISO and POUs. This detailed planning includes the contingency-based power flow modeling and economic grid simulations necessary to confirm the need for and cost-effectiveness of projects in the RETI conceptual transmission plan.

1.3.3 Initial Conceptual Transmission Plan

To develop this initial plan, the Conceptual Planning Work Group started with the revised CREZ, including those representing Out of State resources. It considered alternative network connections for accessing them, and compiled a comprehensive list of

conceptual line segments for this purpose. Using the evaluation methodology described below, it then grouped the line segments into three categories of facilities: Renewable Foundation lines; Renewable Delivery lines; and Renewable Collector lines. Some lines serve two or three of these functions.

1. **Renewable Foundation** lines increase the capacity of the California transmission network between Palm Springs and Sacramento, allowing energy to flow north or south as needed. There are 14 key line segments in the Foundation Group. The capacity these lines provide is likely to be essential to be able deliver renewable energy from any CREZ to consumers in all major load centers. The usefulness of the Foundation Group is not limited to renewable energy. The increased capacity these lines provide is likely to be needed to meet growing energy demand regardless of generation source.
2. **Renewable Delivery** lines move energy from Foundation lines to major load centers. The increased capacity provided by the lines of this group is likely to be needed to meet growing energy demand regardless of generation source. There are 13 major line segments in the Renewable Delivery Group.
3. **Renewable Collector** lines carry power from CREZ to Foundation and Delivery lines. These line segments are grouped geographically into projects capable of accessing adjacent CREZ. There are 12 groupings of collector lines. Several of these lines form portions of or connect to major inter-tie lines connecting California to the western regional grid, and therefore provide access to out of state resources.

The table below sorts these groups of network line segments by the amount of renewable energy they carry; their environmental ratings; and rough estimates of their capital cost. The process used to evaluate line segments and sort them into groups is detailed in Chapter 3.

Please note these important qualifications of the information on Table 1-1:

1. **No Benefit/Cost Analysis**. Both the benefits and the costs of transmission projects must be evaluated over their 50^{+}year lives. The RETI plan, however, looks only to the year 2020. RETI has produced no estimate at all of the benefits that the lines identified might provide in reducing congestion, providing access to lower-cost generation or improving grid reliability; and it provides only a rough estimate of the initial capital cost of each group of projects. RETI cannot and does not make any judgment about the overall benefits and costs of any specific transmission line proposal.

2. **Limited Value of Renewable Energy Rating**. The RETI methodology is geared mainly to evaluate the relative usefulness of line segments, and groups of lines, in carrying renewable energy. Foundation lines carry renewable energy from many CREZ; because larger amounts of renewable energy flow on those lines, they have a higher rating. Collector lines generally carry renewable energy only from one or a few electrically-adjacent CREZ.

   Lower CREZ energy ratings for transmission line groups, however, mean only that lines in a group carry smaller amounts of renewable energy. Groups of lines carrying smaller amounts of renewable energy may be useful and cost-effective projects. The Carrizo Group, for example, is shown on Table 1-1 to carry the smallest amount of renewable energy of any Group of lines in the plan. But it also has the lowest estimated cost and the lowest (best) environmental score; market or customer factors may make it a cost-effective project. The state's 33% renewable energy goal in 2020 notwithstanding, there may be no reason to relegate such a project to a later phase of development, in favor of ones that provide nearer-term access to larger amounts of renewables.

Explanation of information on Table 1-1.

Group Combined CREZ Energy: The CREZ Energy column refers to the amount of renewable energy, in Gigawatt-hours (millions of kilowatt-hours), flowing on the lines in the group. Each of the 14 line segments in the Foundation line group carries renewable energy from several CREZ. As a group, when the flows on each of these lines are added together, they carry a very large amount of renewable energy. Because of this, Foundation lines and Delivery lines are not directly comparable to Collector lines, and have been shown separately on Table 1-1.

Collector lines, such as in the Carrizo group, carry renewable energy only from one or a few CREZ. It is important to note that, because the same renewable energy may flow on multiple line segments, the energy in this column does not represent the amount of such energy delivered to customers.

Group Environmental Rating: In this column, lower numbers represent less environmental concern. Environmental rating of transmission line segments is explained in Section 3.7 of Chapter 3.

Table 1-1. Transmission Groups Sorted by Energy, Environmental Rating and Cost.

Foundation & Delivery Lines			
	Group Combined CREZ Energy (GWh)	Group Enviro Score	Group Cost ($Million)
Foundation	52759	1119	$3,481
Delivery	12945	739	$1,075

Collector Lines					
Group	Group Combined CREZ Energy (GWh)	Group	Group Enviro Score	Group	Group Cost ($Million)
Tehachapi	30,947	Carrizo	20	Carrizo	$78
Imperial	22,219	BarrenRidge	77	LEAPS	$162
IronMt	10,928	Inyo	88	BarrenRidge	$208
Riverside	8,756	Tehachapi	97	Pisgah	$588
Pisgah	8,411	IronMt	131	Inyo	$656
MtPass	6,885	LEAPS	246	Tehachapi	$728
NorthEast	5,055	MtPass	252	NorthEast	$735
LEAPS	4,753	Pisgah	396	MtPass	$798
BarrenRidge	4,618	North	401	IronMt	$832
North	3,536	Riverside	419	Riverside	$1,081
Inyo	2,880	NorthEast	600	Imperial	$1,311
Carrizo	2,351	Imperial	837	North	$3,898
Median	**5,970**	**Median**	**249**	**Median**	**$731**

Foundation lines, Renewable Delivery lines and Renewable Collector lines are shown on the map in Figure 1-2.

Figure 1-2. Foundation Lines, Delivery Lines and Renewable Collector Lines.

1.3.3.1 Least-Regrets Upgrades

Given inherent uncertainties about how much new generation will be needed, where and when it will develop and where load growth will be concentrated, prudent transmission planning emphasizes facilities that are likely to be heavily used under a wide range of planning scenarios. These are referred to as "no-regrets" or least-regrets facilities. Foundation lines and Renewable Delivery lines serving multiple purposes meet this requirement. Some Renewable Collector lines, such as those in the Tehachapi Group, have also been identified as least-regrets facilities. Development of Renewable Collector lines will be phased to accommodate generation, thus minimizing the possibility that these lines would go underutilized. This combination of attributes builds flexibility into the RETI preliminary conceptual plan.

1.3.3.2 Transmission Cost

The conceptual and very rough cost estimates presented in Table 1-1 were prepared using standardized cost factors, to enable comparison of segments on a consistent basis. Preparation of transmission cost estimates is discussed in Section 3.6.

The 14 segments in the Foundation Group, four of which are double-circuit 500 kV facilities, were estimated to have an aggregate cost of $5.6 billion. Because the segments in this group provide major system benefits and are likely to be needed to meet load growth regardless of generation source, it is not appropriate to attribute their cost to the cost of meeting renewable energy or climate change goals. For the same reason, the aggregate cost of the 13 Delivery lines, $3.4 billion, should not be attributed solely or primarily to renewable energy development.

The groups of lines on Table 1-1 provide transmission capacity well in excess of that required to meet the 33% renewable energy goal in 2020. Power flow and economic grid simulation studies to be performed by the CAISO and POUs will determine which lines are needed, and when they should be placed in service. Until such studies are completed, there is little basis for estimating the aggregate cost of the new transmission necessary to meet the 33% goal. Lines will not be approved unless they are found to be needed by permitting authorities.

The crucial point for policymakers and the public is that transmission investment leverages much larger investments in new generating resources. Transmission typically accounts for only a small percentage of the cost of the generation built to deliver energy over those lines. And the value of the energy delivered can repay the cost of the

transmission investment quickly.[8] In addition, transmission lines approved for the primary purpose of delivering renewable generation to the grid will provide other benefits to consumers such as increased reliability, decreased congestion, and greater system efficiency. This report does not attempt to calculate these benefits which, as with detailed, project specific cost estimates, are best evaluated by permitting authorities.

1.3.3.3 Phased Development

The many line segments identified in the preliminary conceptual plan are in different stages of development. Some, like Tehachapi and Imperial Irrigation District (IID) segments, have been studied and approved by the CAISO and IID Board of Directors. Some are in advanced permitting, some are in early stages of development, and others have not yet been proposed as parts of commercial transmission projects.

With these factors in mind, the CPWG identified the earliest feasible in-service dates for each segment. Some IID lines are expected to be in service in 2011; Tehachapi segments, in 2013. Lines in the Foundation Group were estimated to be able to be placed in service in the 2014-2016 period. Several larger projects are not expected to be built until 2020. Maps showing lines that may be able to be placed in service in these development phases (<2013; 2015; 2020) are presented in Chapter 3. Achieving these in-service dates depends heavily on avoiding permitting and litigation delays. Doing so is a major goal of RETI involvement in early-stage project conceptualization.

1.3.3.4 Results and Recommendations

Sorting line segments into functional groups and applying the rating methodology summarized below produces the results shown on Table 1-1. Energy access scores, environmental scores, investment costs and detailed recommendations for each group of transmission projects are discussed in Chapter 3.

With these rating results in mind, and considering also the detailed knowledge of the California grid and the diverse stakeholder perspectives that have been incorporated into the plan presented here, the RETI SSC recommends that:

1. The CAISO and POUs study Renewable Foundation lines and Renewable Delivery lines as soon as possible to determine which are needed, and when they should be placed in service to meet state goals by 2020.

[8] ERCOT 2006. *Analysis of Transmission Alternatives for Competitive Renewable Energy Zones in Texas*. http://www.ercot.com/news/presentations/2006/ATTCH_A_CREZ_Analysis_Report.pdf; ERCOT 2008. *Competitive Renewable Energy Zone Transmission Optimization Study*. http://www.ercot.com/news/press_releases/2008/nr04-02-08. Quoted in US Department of Energy, *20% Wind Energy by 2030*, July 2008, p. 97: http://www.nrel.gov/docs/fy08osti/41869.pdf.

2. In order to avoid duplicative or redundant facilities, California planning authorities work closely with one another to identify, propose, study and approve joint IOU-POU projects, and eliminate barriers to joint use of such facilities.

3. Multiple transmission charges be eliminated for purposes of all transmission line segments built primarily to access and deliver renewable energy in California, so that all transmission customers buying renewable energy sourced from California CREZ pay only one transmission charge. On joint IOU-POU transmission lines, for example, IOU customers would pay only the CAISO transmission charge, and POU customers would pay only a POU transmission charge; in neither case would a customer pay both CAISO and POU transmission charges.

4. The California Energy Commission should begin immediately, per Public Resources Code §25331, to designate additional appropriate corridors, beyond those already established by federal agencies or utilities' rights of way, to reserve and protect transmission access to areas where renewable energy development is likely to occur, including likely routes for Renewable Foundation lines and Renewable Delivery lines. Corridor designation must be coordinated among state and federal agencies and support access to, for example, BLM Solar Energy Zones, and Desert Renewable Energy Conservation Plan (DRECP) generation development areas, as well as to the most likely CREZ.

In addition, specific recommendations regarding development of the Renewable Collector line groups shown on Table 1-1 are presented in Chapter 3.

1.4 Next RETI Activities

1.4.1 Comments on Phase 2A Draft; Preparation of Final Report

The Stakeholder Steering Committee solicits comments on this draft report. Comments are due by Close of Business on June 26,2009. Comments should be sent to Clare Laufenberg Gallardo at the California Energy Commission. They may be sent via e-mail, addressed to: claufenb@energy.state.ca.us; or via U.S. Postal Service, addressed to Ms. Gallardo at: California Energy Commission.1516 Ninth Street, Sacramento, CA 95814. Comments may also be directed to any SSC member.

In addition to written comments, the SSC will hold public meetings to take comment on the draft report in person or via webcast. Notice of such meetings will be posted on the RETI website.

The SSC will consider all comments submitted and will incorporate those it finds appropriate into a Phase 2A Draft Final Report. The SSC is expected to consider the Phase 2A Draft Final Report and adopt a Phase 2A Final Report in early July, 2009.

1.4.2 Coordination with Activities to Implement the Governor's Executive Order

Executive Order S-14-08 directs the Department of Fish and Game and the Energy Commission, in cooperation with the federal Bureau of Land Management and the U.S. Fish and Wildlife Service, to produce a Desert Renewable Energy Conservation Plan (DRECP) by the end of 2010. This plan is to be based on a Natural Communities Conservation Plan (NCCP) for the desert regions of California most affected by potential renewable energy and transmission development. The DRECP will then be subject to CEQA and NEPA review before permits to site generating projects under the DRECP can be issued.

The permitting agencies are expected to build on CREZ identified by RETI in designating areas where renewable energy generation project permitting can be expedited, subject to compliance with the NCCP. Components of the statewide conceptual transmission plan may be adjusted as a result of development of the DRECP.

1.4.3 Next RETI Activities

After completing the Phase 2A report, RETI will work to identify short-term measures that may make it possible for some renewable energy generating projects to be built and connect to the grid in the next few years. These measures will necessarily be developed cooperatively by transmission operators, generators, regulators and other stakeholders. They may include transformer upgrades in certain locations, Remedial Action Schemes, in conjunction with generation curtailment agreements, and other such measures. Results may be collected into a RETI Phase 2B Report later in 2009.

RETI will support detailed electrical planning of the first projects recommended for study at the CAISO and Publicly Owned Utilities. The many interests represented on the SSC are in position to help support consideration of newly proposed projects. Stakeholder support for development of the Tehachapi Renewable Transmission Project plan of service, for example, assisted the CAISO in preparing that project for approval by the CAISO board in 2007.

RETI will also engage stakeholders in support of transmission corridor designation work at the Energy Commission. RETI work to date has collected a huge

amount of information about access to resource areas. This information, and the broad range of stakeholder perspective included on the SSC, will assist the Energy Commission in identifying corridors, not already established by federal agencies or utilities, which minimize costs and impacts and represent the best candidates for formal designation as areas to be reserved for future transmission development.

RETI will update its statewide conceptual transmission plan to correspond to generating siting areas designated by the DRECP, and generation proposals that emerge over the next 18 months. This updated conceptual plan will be timed to correspond to completion of the DRECP in late 2010, in time to inform the CAISO 2011 Transmission Planning Process.

2.0 CREZ Revision

Phase 2 work has revised the descriptions and adjusted the boundaries of several CREZ initially identified in Phase 1. These changes incorporate new information from many sources, including on-the-ground evaluation of permitting and project developability issues. Revised CREZ provide a more accurate basis for estimating the electricity generation potential of biomass, geothermal, solar or wind projects sited in those areas.

2.1 Introduction

Phase 1 CREZ descriptions were based on information available in mid-2008. In many cases, this information was preliminary or incomplete. Commercial interest in renewable generation projects changes in response to market and other factors. Estimates of the viability of potential projects in which no commercial interest has been identified (referred to as "proxy" projects in Phase 1) changes as more information becomes available. Accordingly, one major Phase 2 task was to update and revise Phase 1 CREZ descriptions as appropriate.

The SSC formed a CREZ Revision Working Group (CRWG) to perform this task. It is chaired by the co-chairs of the Environmental Working Group (EWG), and meets regularly by web conference and frequently in person. CEC staff continues to provide invaluable support to the group.

The CRWG evaluated boundaries of some CREZ to avoid sensitive lands, based on more recent information not available in Phase 1. These include BLM lands, such as Desert Wildlife Management Areas (DWMAs), subject to a 1% cap on all forms of development. The CRWG also obtained information about previously disturbed land in the vicinity of some CREZ, and attempted to redraw CREZ boundaries to make use of such lands.

Proxy solar projects identified in Phase 1 were located in areas of high insolation with suitable slopes and distance from known structures. At the time, no information was available about the underlying land ownership patterns. Highly fragmented ownership makes energy development unlikely, so a major Phase 2 task was to ensure that proxy projects were located in areas with only a few different owners, as described below.

Phase 1 CREZ were further revised by updating the list of generation projects in which commercial interest has been expressed ("pre-identified" projects) based on new information from the Bureau of Land Management, the California Energy Commission,

the California ISO, and publicly-owned utilities (POUs). More precise locations and descriptions of many of these projects are now available and have been used in Phase 2 CREZ descriptions.

The CRWG re-assessed the revised CREZ using the process described in the Phase 1B Report, and calculated new economic and environmental ranking scores. These revised CREZ ranking scores are used to prioritize components of a preliminary statewide conceptual transmission plan.

2.2 CREZ Revision

2.2.1 Land Ownership Fragmentation Issues

Initial CREZ revision work was divided into four subtasks:

- Acquisition of parcel maps and ownership lists for Southern California counties;
- Preparation of maps overlaying parcel information with Phase 1 CREZ and generation project data;
- Identification of problem proxy projects with underlying parcels having more than 20 different owners per two square miles;[9]
- Eliminating, moving, or reshaping problem proxy projects.

The location of major commercially viable renewable energy resources in California is well known. Nearly all of the renewable generation projects proposed by commercial developers were grouped into 29 CREZ in Phase 1. However, the potential for commercial energy development in these zones is greater than may be indicated by "pre-identified" generation projects alone. This is especially true for solar energy development, given the huge, high-quality solar resource available and the relative newness of solar technologies as a source of large-scale electric generation.

In order to estimate the cost and environmental concerns associated with the total potential solar development in a CREZ, RETI placed "proxy" solar projects on CREZ maps, primarily in the Mojave Desert region where solar radiation makes their output most cost effective, and included these projects in CREZ for purposes of its analysis. RETI assumed that these proxy solar projects would utilize conventional solar trough technology, which requires relatively flat land having a slope of no more than 1%. In addition, it was assumed that commercially viable solar projects using this technology must be at least 200 megawatts (MW) in size, requiring 2 square miles of area.

Using maps available on Google Earth and other data, locations were identified which appeared suitable for solar thermal development, having relatively flat land, no structures, good insolation, and other such factors. A proxy solar project was represented on RETI maps as a square area containing 1280 acres (2 square miles). These are shown as the orange squares in Figure 2-1 below. In preparing the Phase 1 report, RETI work groups recognized that such high-level identification of apparently suitable sites could include areas which might not prove to be suitable due to land ownership complications.

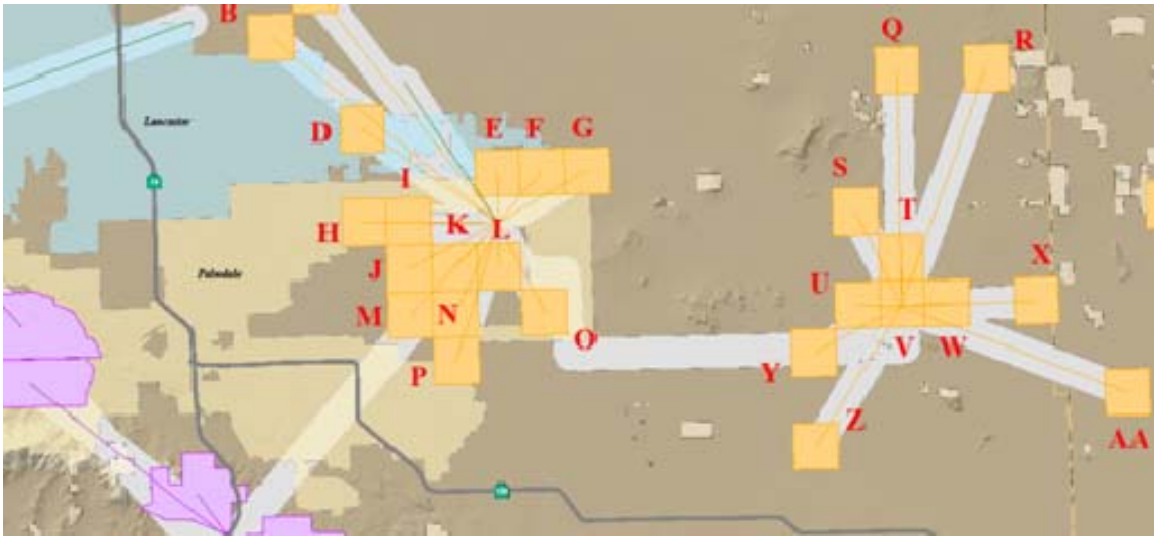

Figure 2-1. Kramer CREZ Solar Proxy Projects in Phase 1B Report.

During Phase 1 work, no information was available on the degree of parcel and ownership fragmentation of the land underlying these proxy projects. Energy Commission staff obtained and compiled that data and the CRWG analyzed it for all CREZ in Southern California. A few CREZ were found to have highly fragmented ownership. Figure 2-2 below shows the orange squares of Kramer CREZ proxy projects, with boundaries of underlying parcels shown in black.

[9] This criterion was adopted on the advice of solar industry representatives.

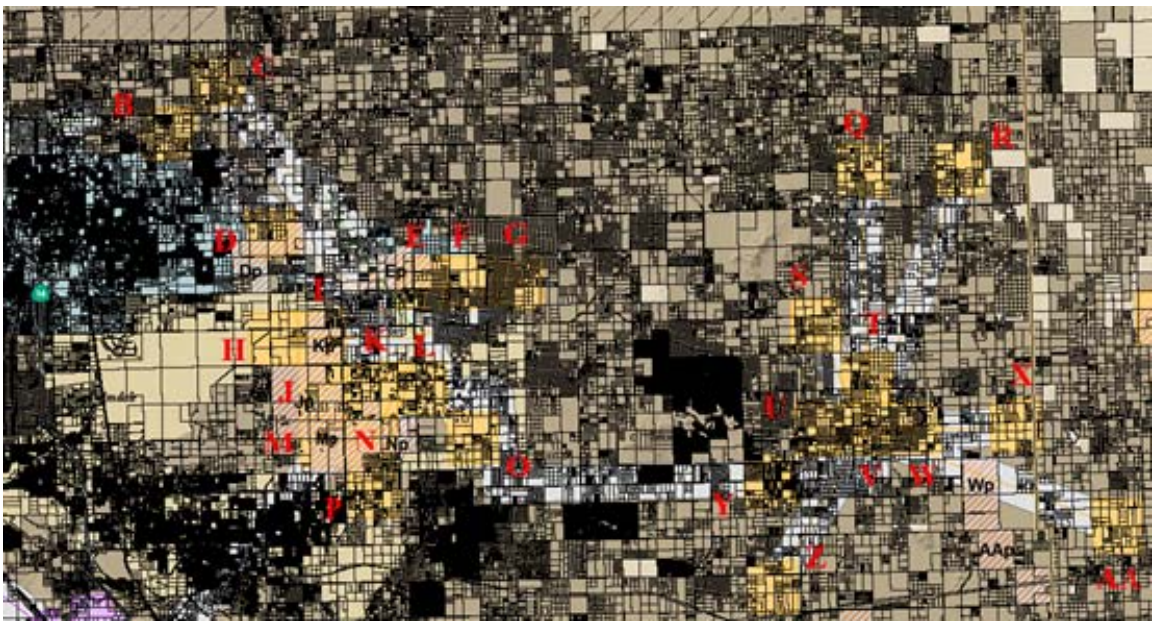

Figure 2-2. Kramer CREZ Solar Proxy Projects in Phase 1B Report Showing Underlying Parcels.

Proxy projects located on parcels having 20 or more different owners have been removed from the CREZ or reshaped to avoid this problem. Such ownership fragmentation makes it unlikely that projects will be developed on these sites in the 2020 time frame. New proxy projects were placed on qualifying lands.

In the case of the Kramer CREZ, as shown in Figure 2-3, all 32 Phase 1 proxy project sites in the Kramer CREZ that had more than 20 separate property owners were replaced with new proxy sites on nearby lands that had 20 or fewer property owners for each 2 square mile site. In others, such as the Fairmont CREZ, it proved impossible to identify replacement locations for the many sites that had to be eliminated due to parcelization issues.

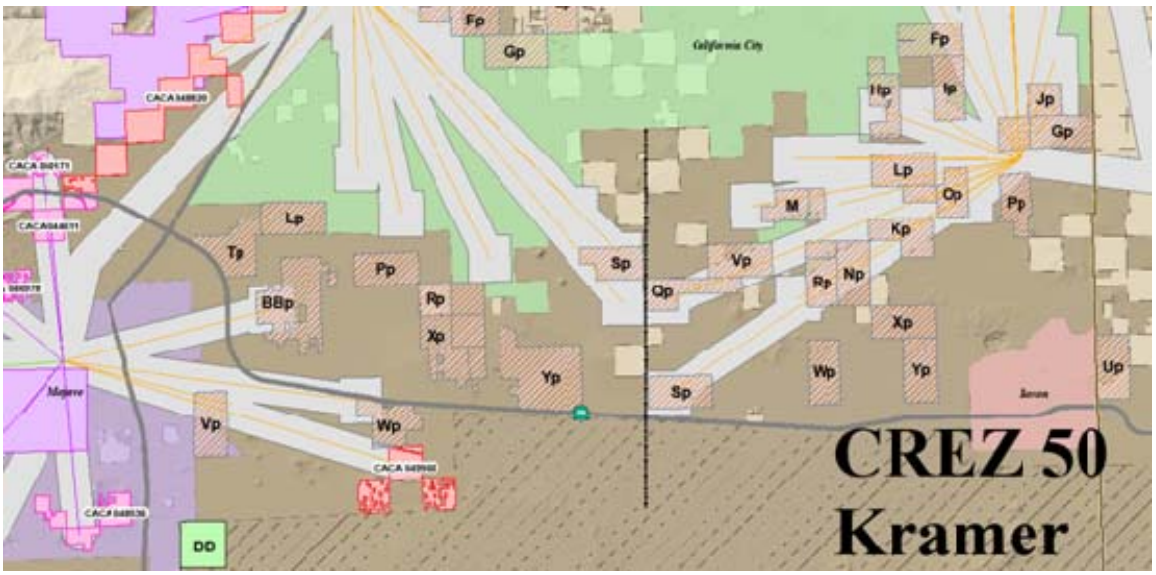

Figure 2-3. Kramer CREZ Solar Proxy Projects Relocated During Phase 2 CREZ Refinement.

The SSC believes proxy projects remaining in Phase 2 reflect realistic solar development potential. As a result of the revisions, descriptions of some CREZ have changed significantly, especially in the Western Mojave area where many old subdivisions are located.

2.2.2 BLM Development Caps

Bureau of Land Management (BLM) management plans for certain areas limit all forms of development to 1% of the land area of subject regions. These include Areas of Critical Environmental Concern (ACECs), Desert Wildlife Management Areas (DWMAs) and areas covered by Habitat Conservation Plans (HCPs). The acreage available for energy development in affected areas, if any, is unknown and depends on future decisions by BLM, but it clearly must be less than 1% of the total in all of these areas. It is uncertain how BLM will estimate the development area for wind projects since the area disturbed by turbines and roads is a small fraction of total lease area. There are indications that BLM will consider wind development area to be somewhere between 5% and 10% of total lease area, on a case by case basis.

The CRWG reviewed CREZ areas which may be subject to the 1% development cap to ensure that proposed development does not exceed BLM limits. Table 2-1 presents the results of the 1% cap assessment.

Table 2-1. 1% Cap Assessment for Desert Wildlife Management Areas.

Name of DWMA	Superior-Cronese	Fremont-Kramer	Ord-Rodman	Piute-Fenner
DWMA acres	542,739	418,458	224,623	219,092
1% of DWMA	5,427	4,185	2,246	2,191
TT Wind Project Acres	46,460	8,239	7,192	9,270
7.5% Wind Acres	3,485	618	539	695
% of 1%	64.2	14.8	59.9	31.7
TT Solar Project Acres	0	0	806	0

2.3 Revised CREZ Ranking

The CRWG used revised CREZ descriptions to re-rank CREZ based on economic and environmental issues, employing the same process described in the Phase 1 B Report.[10,11]

The bubble chart below in Figure 2-4 shows revised CREZ assessments in terms of relative economic cost and environmental concerns per unit energy produced. As in the Phase 1B Report, CREZ to the left in this chart are expected to have fewer environmental concerns per unit energy production, and CREZ toward the bottom are expected to have lower cost/higher economic value per unit energy. As described below, five Out of State resource areas have been included in this chart. Since comparable environmental data is not available, these areas have been assigned an environmental value equal to the median value for California CREZ.

Unlike the bubble chart in the Phase 1B Report, however, the Phase 2 CREZ economic ranking scores presented on the chart below do not include transmission costs associated with each CREZ. In Phase 1, such costs were estimated from computer models. For this revision, the RETI Conceptual Planning Work Group has instead directly analyzed the cost of individual transmission facilities needed to provide access to each CREZ. Development of transmission costs for each component of the statewide plan is described in Section 3.6 below.

[10] As discussed below, an environmental matrix was developed by the CRWG to supplement the Phase 1B ranking process.

[11] As reported in Phase 1B, consensus could not be reached on how wind project footprint should be defined and applied in CREZ environmental ranking. The wind industry takes strong exception to the formulas applied. Its alternate CREZ ranking is described in Section 3.4 and Appendix E of the Phase 1B EWG Report, *Environmental Assessment of Competitive Renewable Energy Zones.*

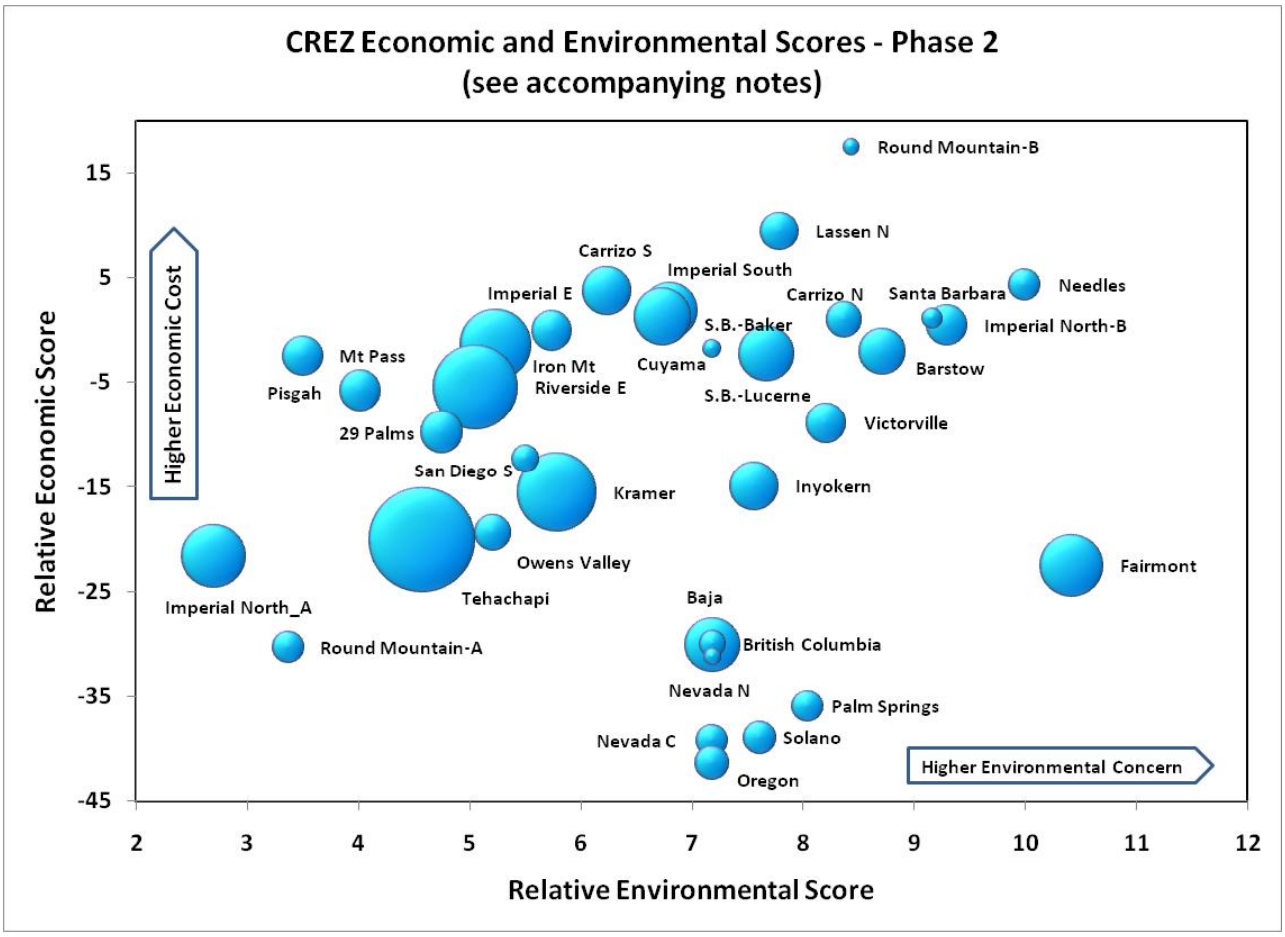

Figure 2-4. Phase 2 CREZ Economic and Environmental Scores, Bubble Chart.

Notes:
Areas of the bubbles are proportional to CREZ energy.
Out of state CREZ economic scores include proxy costs for delivering energy to the California border.
Lassen South CREZ is off the right side of the chart. Economic Score = 1.81 Environmental Score = 19.43 Energy = 1106 GWh
San Diego North Central CREZ is off the right side of the chart. Economic Score = -0.32 Environmental Score = 22.24 Energy = 739 GWh

CREZ economic assessment depends on many assumptions about generating technology costs and output characteristics, collector system transmission costs, and the

locational, seasonal and diurnal value of the electricity generated; and on assumptions about policy support and technology development. Results of CREZ economic assessment to date, for example, do not include the effect of the Production Tax Credit (PTC) approved by the Congress in early 2009. Despite general SSC agreement on the assumptions to be used in economic evaluation of CREZ, as described in the RETI Phase 1A and Phase 1B Reports, many input assumptions remain inherently uncertain. Phase 1B conducted an uncertainty analysis to illustrate the effects of different input cost and value assumptions. This analysis showed that different, but reasonable, assumptions about cost parameters make some CREZs relatively more or less economically attractive. Using updated Phase 2A values, Figure 2-5 presents a CREZ economic supply curve with a band representing the range of uncertainties for CREZ economic scores.

[Figure 2-5. CREZ Economic Supply Curve with Uncertainty Band to be provided in Phase 2A Draft Final Report]

2.4 Out of State Resources

Consideration in Phase 1 of renewable resource regions located out of state was limited by the lack of environmental data comparable to that available for California. RETI participants worked to find this information for use in the Phase 2 report, so that out of state areas could be assessed on a basis comparable to that used for California CREZ, but such data does not appear to exist or is otherwise unavailable.

For purposes of conceptual transmission planning, resources from British Columbia, Oregon, Northern and Southern Nevada, and Baja California have been treated as CREZ. Economic scores for resources in those areas were computed on the same basis as California CREZ. In the absence of environmental data on out of state resources, RETI Phase 2 ranking assigned the median environmental score for California CREZ to each of the out of state areas.

In Phase 1, Black & Veatch evaluated the economics of potential of wind and solar *projects* in California, whereas for Out of State regions they evaluated only the development potential of resource areas. (They evaluated biomass and geothermal resources on a project-level basis both in-state and Out of State). For Baja California, they considered wind resources only in the border region; Rocky Mountain resources were not considered at all. Efforts to obtain a more detailed assessment of the economic potential of Out of State resource are underway. The SSC will consider using revised estimates of cost-competitive resources from Out of State areas in future RETI work, if they can be well-enough documented to provide a basis for supplanting those used in Phase 1.

2.5 Proposed Mojave Desert National Monument

The Mojave Desert National Monument contemplated by California Senator Dianne Feinstein would affect at least a few CREZ, if in fact it is created in legislation. Monument boundaries have not been established, but very roughly the area that has been talked about runs from Needles, CA to the vicinity of the Pisgah Substation along Route 66, and then north from the northeast boundary of Joshua Tree National Park to the southern border of Mojave National Preserve. Establishment of a monument including this general area would eliminate approximately 11,700 MW of potential solar and wind generation in the Pisgah, Iron Mountain, Baker and Needles CREZ.

Because of the uncertainty surrounding creation of the monument and its boundaries, RETI has not modified the energy and environmental scores of these three potentially affected CREZ in its Phase 2 work. With the assistance of the EWG, however, some transmission line segments were changed to avoid the area potentially affected by the monument. The remaining transmission line segments necessary to access generation in these CREZ were evaluated and rated by the environmental expert panel.

RETI will follow plans for creation of the monument closely and modify CREZ designations and supporting transmission facilities as appropriate.

2.6 Environmental Issues Matrix

As noted in Phase 1, a variety of local environmental issues is expected to affect the commercial viability or permitting of many renewable generation projects. Detailed local information with which to evaluate these concerns quantitatively remains incomplete and RETI work groups made no attempt to incorporate it into the CREZ re-ranking process.

The CRWG, however, developed a matrix of potential environmental issues to serve as a checklist for evaluating CREZ in which these issues may be of significant concern. Table 2-2 below indicates the types of issues included on this matrix. Although it does not provide quantitative information for CREZ re-ranking, the matrix is expected to be useful in estimating the rate of future development and the timing of future transmission needs. An expanded version of the environmental issues matrix for each CREZ is included in the online supporting materials, as referenced in Appendix C.[12]

[12] Online supporting materials can be found at http://www.energy.ca.gov/reti

Table 2-2. Example CREZ Environmental Concern Matrix: CREZ 50.

CREZ 50 - Kramer	Solar	Wind	Geothermal	Comment
Phase 1b capacity (MW)	6400 MW	203 MW	24 MW	
Phase 1b CREZ Acres	40960 Ac	16544 Ac		Solar 6185 MW, Wind Testing 0 MW
Process Issues				
PPAs Submitted/Approved to CPUC or Local Regulatory Authority				
Application filed	5033 Ac	16859 Ac		585 MW solar proposed
Wind Testing				
Application actively pursued				
Permit decision issued				
ISO queue - Serial	330 MW			
ISO queue - Transition	2720 MW			
ISO Queue- GIPR	0			
Resource Conflicts/Controversies				
More than 20 owners/2 sq. mile proxy project	40660 Ac			32 Proxys moved to less than 20 owner sites.
Applicable HCP, NCCP	0	0	0	
Williamson Act contractWilliamson Act contract	0	0	0	
Zoning (example: general plan amendment or rezoning required)	34176 Ac.			33527 Ac. CUP/ 648 Rezone
Known cultural resources including historic trails and or highways.		6205 Ac		
ACECs present	0	0	0	
DWMA		6271 Ac 28 Ac		Fremont-Kramer CACA 048537 1.5% of 418458 Acres Fremont-Kramer CACA 050319 <1% of 418458 Acres
Mojave Ground Squirrel habitat		21645 Ac		
Number of special status species present	65			Solar quantity accounts for entire CREZ
Important/Sensitive Habitat				No Assessment performed
Military Constraints				No Assessment performed[13]
Wildlands Conservancy lands present	0	0	0	0
Citizen proposed wilderness present	0	0		
Other (example: BLM says commercial wind is tapped out near Palm Springs)				
Advantages				
Additional lands identified for project development	3296 Ac			Abengoa-Mojave Solar One 250 MW, 2496 Acres, FPL 800 Acres.
Significant acreage of disturbed lands	0	0	0	
Revised CREZ Acres	42099 Ac	41870 Ac		

[13] Renewable energy facilities, particularly wind and transmission, have the potential to negatively impact military activities. Currently, exclusion based solely upon military constraints is not reasonable. However, specific projects will be reviewed by the military to determine impacts, and could affect development.

3.0 Conceptual Transmission Plan

RETI's central task revolves around identifying transmission facilities capable of delivering sufficient renewable energy to meet state goals, in ways that minimize economic cost and environmental impact. The conceptual plan presented in this report summarizes the facilities the SSC has identified for detailed study. They are designed to be developed in phases, over the period to 2020. Perhaps most importantly, this plan integrates the perspectives and concerns of a wide variety of California stakeholders into a consensus recommendation for such transmission development.

This section presents a preliminary conceptual transmission plan and describes the considerations and process used to develop it.

3.1 Conceptual Transmission Planning

Transmission development proceeds through several stages. Conceptual transmission planning is the first of these. In this stage, planners evaluate electrical alternatives for connecting new generation to the grid and ensuring that it will reliably be delivered to population centers. Conceptual planning revolves around analyzing electrical connections between substations, to determine whether existing connections can accommodate injections of power from new resources, whether they must be expanded, or whether new connections must be built. Because it focuses on electrical flows, conceptual planning generally does not identify geographic routes. The important exception is that this early-stage planning does consider whether existing transmission facilities can be upgraded or whether new lines can be added in or adjacent to existing corridors.

The RETI Stakeholder Steering Committee unanimously agreed that environmental concerns should be considered from the very first effort to identify potential electrical connections necessary to access renewable generation. This is a major innovation that may help to expedite the later permitting of any facilities that ultimately advance to more detailed study. A later section of this report describes integration of environmental concerns into Phase 2 conceptual planning.

Conceptual plans identify potential transmission projects. Transmission owners, most of whom are also Load-Serving Entities responsible for delivering power to customers, then propose specific transmission projects for detailed study by the CAISO or by POU planners. Proposed projects must be found to be needed to maintain system

reliability, make lower-cost power available to consumers, or to provide access to renewable generation.

To determine whether or not a proposed project is needed, and can be added to the grid without compromising system reliability, the second stage of transmission development is preparation of "plans of service" for each proposed project. Engineers conduct power flow studies to evaluate how every major element of the Western Interconnection grid performs, under a wide range of system conditions, when the proposed transmission facilities and associated generation are added to the grid. These studies identify how system operation will change with the new facilities added, and what electrical equipment may have to be added in specific locations around the grid to ensure that system reliability will not be compromised. Planners also employ production cost models to evaluate how the proposed facilities affect the cost of power to generators and consumers across the entire grid, and affect system fuel consumption and emissions. The benefits of a project can then be compared to its costs. Transmission projects that show net benefits and maintain or enhance system reliability are then presented to POU governing boards or the CAISO board of directors for approval.

Geographic routing of proposed projects often takes place in parallel with preparation of plans of service. Routing involves identification and study of several alternatives. Environmental studies required for most projects typically take more than a year to complete and affect routing decisions. IOU projects must submit an application to the CPUC for a Certificate of Public Convenience and Necessity (CPCN) containing a Proponent's Environmental Assessment of the proposed project and alternatives to that project. POU projects follow a similar process. Agency consideration of transmission applications is a public process and is affected by the considerations and concerns identified by the public.

If the CPUC or POU governing board issues a permit to construct the proposed transmission, the project proponent then completes additional environmental permitting, in compliance with state and federal requirements; land acquisition; performs final engineering, for example of substation layout, and tower alignment and spacing; procures equipment and finalizes construction scheduling. The overall transmission development process typically requires 7-10 years from conceptual planning through construction.

RETI's Environmental Work Group (EWG) applied its collective knowledge of sensitive lands and permitting issues to identify potential electrical connections that would likely face legal, mitigation, or public opposition challenges. It worked with the CPWG to find ways to re-route or remove affected electrical connections from

consideration. Because of this screening, the Phase 2 preliminary conceptual plan may draw wider stakeholder support, and later, may result in projects able to be approved more quickly.

3.2 Conceptual Transmission Planning Work Group

The SSC formed a Conceptual Planning Working Group (CPWG) to develop a statewide conceptual transmission expansion plan. Work Group members include representatives of all major transmission providers, Load-Serving Entities (LSEs), regulatory and permitting agencies, renewable energy generators, environmental organizations, and other stakeholders. The Work Group met bi-weekly beginning in October 2008; from January 2009 on, it then met weekly, in person and via web conference. The Work Group also formed subcommittees to perform focused studies.

3.3 Conceptual Plan Development and Assessment

3.3.1 Transmission Components in the Conceptual Plan

Using its collective judgment, the CPWG first developed a comprehensive list of potential transmission solutions for accessing all CREZ and cost-effective out of state resource areas. Adding approximately 60,000 GWh of energy to the statewide grid and making it deliverable to customers across the state will require upgrade or expansion of many elements of the transmission system as well as the connections necessary to resource areas. Facilities in the plan include not only connections to individual CREZ but also expansions of existing major elements of the high-voltage grid needed to deliver power to load centers. These include, for example, “gateway” substations where large amounts of power enter the Los Angeles Basin, and expansion of transfer capacity between Southern and Northern California.

Many of these facilities had already been identified by transmission owners, and others were added to the list as found necessary to provide transmission access to renewables. All of the components of the preliminary statewide conceptual plan are “network” connections in which power flows in both directions. Radial “trunklines” and “gen-ties,” in which power flows predominantly in one direction, from a CREZ to the network, will be considered in future work.

The initial list of new network transmission facilities was then revised with the help of the EWG to eliminate or re-configure facilities in areas of special environmental sensitivity. The resulting shorter list of facilities constitutes this initial RETI conceptual

statewide transmission plan. A complete list of new facilities included in the preliminary conceptual statewide plan is found in Appendix H. The plan still includes a few segments likely to be redundant, an issue which will be addressed in future assessments.

Not all of the energy from all CREZ will be needed to meet a 33% RPS goal. Consequently, not all of the facilities in the conceptual plan will be needed. It is impossible to know today which will be needed and which not. Transmission capacity needed to access CREZ and collect renewable energy will be determined by the pattern and rate of CREZ development. Upgrades to Foundation lines, which enable energy to move throughout the state, may be needed to the extent that the existing system has insufficient capacity to do so. RETI does not have the capability to assess such need. Upgrades required to deliver energy to load centers depend on load growth, changes in local generation, including local PV installation, and grid reliability-related factors.

RETI's mandate is to identify, from a statewide perspective, additional transmission capacity sufficient to provide access and delivery of renewable energy equal to 160% of the net short in 2020. As discussed above, which conceptual plan components will be needed for this purpose by 2020 will be determined by further study and future developments.

3.3.2 Minimizing New Rights of Way

RETI developed its conceptual transmission plan from the outset with a goal of minimizing the impacts of transmission development associated with meeting state renewable energy and greenhouse gas reduction goals. The most effective way to do this is first, to establish the extent to which the existing grid can accommodate new renewable generation; and then to minimize the number and amount of new Rights of Way required to meet the renewable net short goal. To this end, electrical connections in the plan utilize existing transmission corridors and existing Rights of Way (ROW) to the greatest extent possible. The CPWG looked first for situations where existing lines could simply be reconductored or upgraded with new towers, and then for situations where new lines could be added in parallel to existing lines. In some cases, this would require widening the existing ROW or co-locating the lines adjacent to existing ROW.

Environmental evaluation of transmission facilities in the conceptual plan is outlined in Section 3.7 below.

3.3.3 Plan Assessment Methodology

The electrical function of each proposed line segment was evaluated to assess its relative usefulness in providing access to renewable energy resources in California and neighboring states, enabling energy transfers between major load centers, and delivering energy to those loads. Individual proposed line segments were combined into functional groups, and the line segment information was combined to provide information for each group. This methodology is shown schematically in the flow chart in Figure 3-1.

The plan assessment methodology can be thought of as a five-step process:

1. Transmission system modeling – In the first step, all of the proposed new network transmission elements in the plan were added to the western regional transmission system expected by the Western Electricity Coordinating Council (WECC) to be in place for the year 2018.

2. Shift Factor Calculations – This transmission system configuration, with the proposed new network facilities added, was analyzed for RETI by San Diego Gas & Electric Company using the ABB GridView computer program. The program injects a small amount of energy from each RETI CREZ, one at a time, and withdraws this energy at LSE load centers, in proportion to each LSE's net short estimates. The program calculates the fraction of these small energy injections which would flow in every segment of the WECC grid, including the proposed RETI line segments. These fractions are known as "power distribution factors" or "shift factors." They provide the basic information on the energy from each CREZ which flows in each line segment of the conceptual plan.

3. The shift factors were then combined with four different sets of energy information associated with each CREZ to provide a renewable energy rating for each line segment. The four rating criteria employed capture the economic and environmental score of each CREZ, as revised in Phase 2; the energy output of each CREZ; and commercial interest, represented by the amount of energy able to be provided by projects having Power Purchase Agreements and/or queue positions in each CREZ.

4. The line segments were then combined into functional groups, with line segment information combined to provide overall results for each group.

5. Environmental ratings and investment cost for each line segment were also compiled for each group, alongside group energy ratings. This information is summarized for comparison purposes on Tables 3-7 and 3-8 below.

If all the proposed line segments were in place, the assessment provides a relative measure of how much renewable energy can be expected to flow in any line segment. The shift factor assessment does not provide information about whether any line segment is "needed" for renewable energy to move from CREZ to loads. Perhaps the existing transmission system is adequate to transmit this energy, for example.

In future work, RETI will remove some of the proposed line segments from the plan and assess those remaining. This will provide additional information that will help prioritize line segments and groups of segments. It will not, however, determine whether or not any new line segment or group of segments is "needed" to transmit renewable energy. Doing so requires use of more sophisticated power flow economic dispatch models, and the studies involved are beyond RETI's scope.

Despite its limitations, shift factor analysis is a useful assessment tool in transmission planning. It provides information regarding the *likelihood* that any individual line segment or group of segments will be a valuable addition to the system under, in this case, the conditions assessed by RETI, for purposes of providing access to resource areas and delivering renewable energy to consumers.

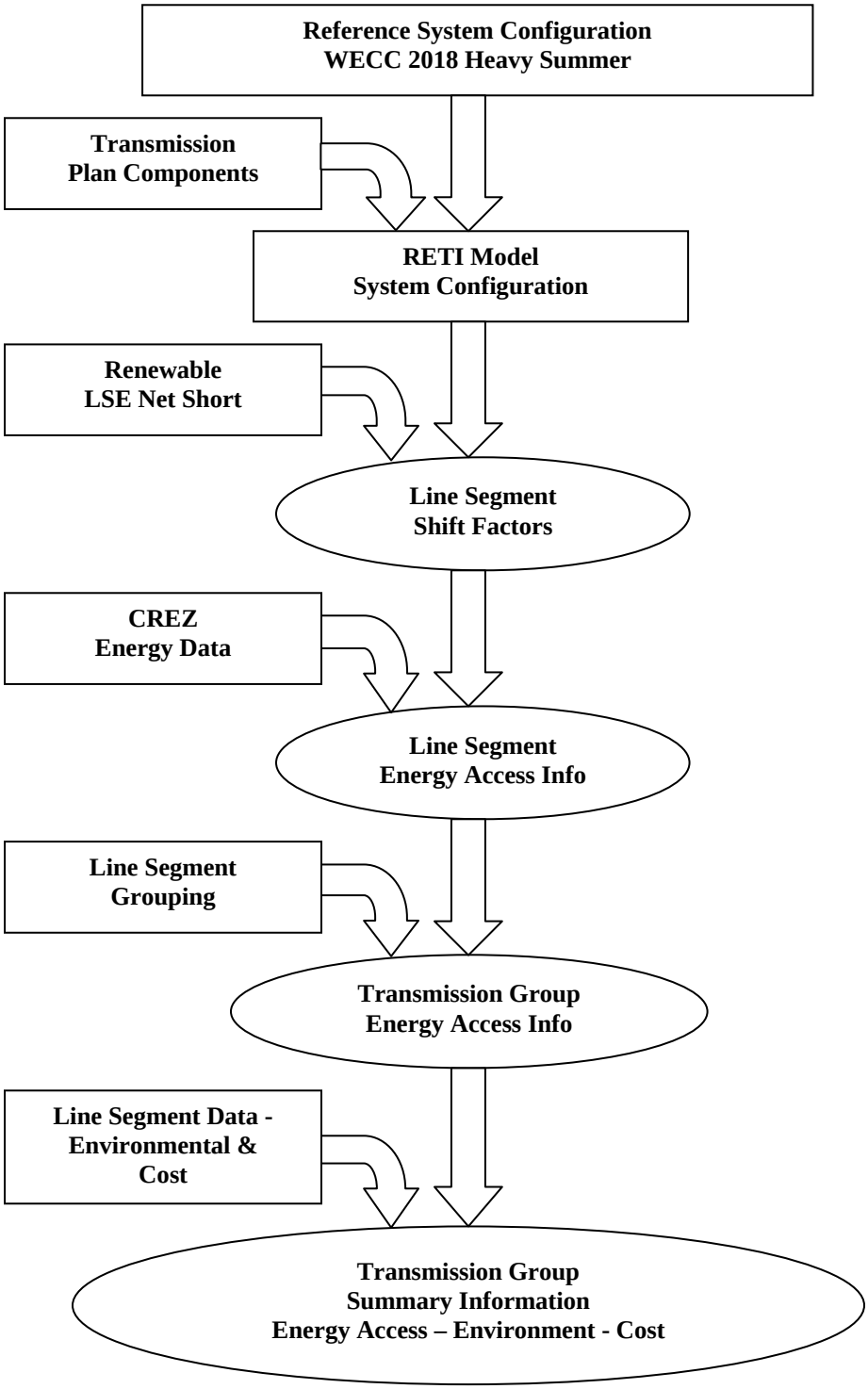

Figure 3-1. RETI Conceptual Plan Assessment Methodology Flow Chart.

3.3.3.1 Conceptual Plan Renewable Net Short

An essential input to the assessment methodology for calculating shift factors is identification of the expected demand for renewable energy in each load center. In essence, this information tells the computer program where the energy from the CREZ needs to go.

The collective need in California for additional renewable energy to meet a 33% Renewable Portfolio Standard (RPS) was computed in RETI Phase 1 and is referred to as the statewide renewable net short. The statewide net short was revised in Phase 2 to correct an earlier error in the data and to more accurately reflect renewable energy likely to be generated locally from photovoltaic (PV) installations, thereby reducing the need to transmit renewable energy from remote CREZ.[14]

For purposes of conceptual plan assessment, the net short for each LSE was computed from estimated demand in 2020 and RPS eligible retail sales in 2008. The total for all LSEs was in excellent agreement with the original Phase 1 net short estimate. In the absence of information about LSE expectations for local PV generation, the values of individual LSE net short requirements were used for purposes of system modeling and shift factor calculations, despite the fact that their total was higher than the revised estimate. However, the assessment results would not be different if the net short positions of LSEs had been uniformly scaled downward to reflect assumed uniform penetration of local PV generation.

LSE net short positions used for shift factor calculations are shown in Table 3-1 below:

[14] RETI Phase 1B Final Report Update: Net Short Recalculation and New PV Assumptions With Revisions Adopted February 24, 2009. Available at: www.energy.ca.gov/reti.

Table 3-1. Forecast of LSE Renewable Net Short Positions in 2020.

LSE Name	Total Retail Sales (2020) (GWh)	RPS Retail Sales 2008 (GWh)	Net Short 2020 (GWh)
SMUD			2,084
Other TANC			2,000
PG&E	93,627	9,774	21,123
PG&E Direct Access	6,814	NA	2,249
SCE	99,142	12,573	20,144
SCE Direct Access	9,405	NA	3,104
LADWP	27,776	1,968	7,754
IID	4,216	671	720
Other SCCPA	9,969	498	2,791
SDG&E	21,113	1,047	5,920
SDG&E Direct Access	3,113	NA	1,027
Totals			**68,916**

3.3.3.2 Shift Factors

In the complex network of the electric grid, energy from any generator spreads throughout every network link in the Western Interconnection at almost the speed of light. Energy used by any customer is drawn from the complete network and cannot be said to come from any individual generator. Evaluating the degree to which a particular line segment is useful in distributing renewable energy from a particular CREZ is therefore a sophisticated process.

The assessment process adopted by the SSC computes a set of "shift factors", also known as distribution factors. These numerical shift factors provide a relative measure of each new line segment's usefulness in transmitting energy from each CREZ.

To calculate shift factors for individual transmission line segments, all of the segments in the conceptual plan were assumed to be connected. Demand for renewable energy by each LSE was assumed to be equal to its net short, as discussed above. In order to ensure that energy from the CREZ flows to LSEs sufficient to meet renewable energy and greenhouse gas reduction goals, LSEs also identified the proxy location or locations

at which the renewable energy was to be considered delivered for purposes of shift factor calculations.

The shift factor calculation process sequentially inserts one megawatt of power into the grid from each CREZ and computes the percentage of this additional power that flows in every line segment throughout the Western Interconnection. The percentages flowing in each of the line segments included in the RETI conceptual statewide plan are tabulated in a matrix. Since more than 100 new line segments were considered to provide access to 35 CREZ, more than 3,500 shift factors were computed. The complete shift factor matrix is found in the Online Supporting Materials posted with this report. A small sample of the matrix is shown in Table 3-2 below.

Table 3-2. Extract of Shift Factor Matrix.

	INYK_KRAM_1	IRMT_SCEJ_1	IRMT_SCEJ_2	JULH_DESC_1
Owens Valley	0.6588	0.0058	0.0058	-0.0006
Palm Springs	0.0002	-0.0261	-0.0261	-0.0016
Pisgah	0.0000	0.0142	0.0142	-0.0021
Riverside East	0.0003	-0.0636	-0.0636	-0.0262
Round Mountain-A	-0.0013	0.0046	0.0046	0.0000
Round Mountain-B	-0.0013	0.0046	0.0046	0.0000
San Bernardino - Baker	0.0006	0.0045	0.0045	0.0008
San Bernardino - Lucerne	0.0000	0.0106	0.0106	-0.0015

A positive shift factor indicates that energy from the CREZ moves in the line segment from the first substation listed to the second. A negative value indicates that the flow is in the opposite direction. For example, the first row of the table shows that 66% of the energy from the Owens Valley CREZ flows in the INYK_KRAM_ segment from the Inyokern substation to the Kramer substation. Row 5 of the table shows that 0.13% of the energy from the Round Mountain-A sub-CREZ flows from the Kramer substation to Inyokern, thereby canceling out some of the flow from Owens Valley.

Since flows from different CREZ may occur at different times of day or year opposing flows cannot be counted on to cancel each other out. Therefore, the absolute values all shift factors are used in the plan assessment, providing a measure of total energy access to all CREZ.

3.3.3.3 CREZ Data

CREZ data used in the conceptual plan assessment has been updated from Phase 1 using the same methodology. Summary results are shown in Table 3-3.[15]

On Table 3-3, the column headed **Total Energy** shows the total amount of energy that each CREZ is estimated to be able to produce, in Gigawatt-hours (GWh). The column headed **Net Short Total** shows CREZ energy output, in GWh, with that output reduced proportionally so that the aggregate of all CREZ equals the Renewable Net Short, in GWh, estimated to be required statewide in 2020. The column headed **Phase 2 EconScore** represents the revised Phase 2 economic ranking of each CREZ, as presented on the CREZ bubble chart in Figure 2-4. As on that chart, lower economic scores represent lower-cost (higher value/more attractive) energy. The column headed **Phase 2 EnviroScore** lists the environmental ranking of each CREZ, again as presented on the CREZ bubble chart in Figure 2-4. In this column, as on the CREZ bubble chart, lower environmental scores indicate relatively less environmental concern.

Values in the columns headed **Phase 2 Adj EconScore** and **Phase 2 Adj EnviroScore** are used in the rating criteria formulas, described below, to evaluate the energy access provided by transmission line segments.

[15] Some projects are expected to change between the Iron Mountain and Pisgah CREZ in the RETI Phase 2A Final Report. This will increase the estimated energy output of the Pisgah CREZ and reduce that of the Iron Mountain CREZ.

Table 3-3. Summary CREZ Data.

CREZ Name	Total Energy	Net Short Total	Phase 2 EconScore	Phase 2Adj EconScore	Phase 2 EnviroScore	Phase 2Adj EnviroScore
Baja	8,035	2,243	-30.11	47.57	7.19	15.06
Barstow	5,856	1,635	-2.10	19.56	8.72	13.53
British Columbia	1,849	516	-30.00	47.46	7.19	15.06
Carrizo North	3,395	948	0.95	16.51	8.37	13.87
Carrizo South	6,440	1,798	3.72	13.74	6.24	16.00
Cuyama	892	249	-1.77	19.23	7.19	15.06
Fairmont	10,355	2,891	-22.55	40.01	10.42	11.82
Imperial East	4,201	1,173	-0.09	17.55	5.74	16.50
Imperial North-A	10,626	2,966	-21.62	39.08	2.70	19.54
Imperial North-B	4,507	1,258	0.44	17.02	9.30	12.95
Imperial South	8,185	2,285	1.84	15.62	6.81	15.44
Inyokern	6,322	1,765	-14.95	32.41	7.57	14.68
Iron Mountain	13,383	3,736	-1.48	18.94	5.24	17.00
Kramer	16,553	4,621	-15.55	33.01	5.79	16.46
Lassen North	3,784	1,056	9.41	8.05	7.79	14.45
Lassen South	1,106	309	1.81	15.65	19.43	2.81
Mountain Pass	4,336	1,210	-2.50	19.96	3.50	18.74
Needles	2,649	740	4.26	13.20	10.00	12.24
Nevada N	822	229	-31.20	48.66	7.19	15.06
Nevada C	2,624	733	-39.20	56.66	7.19	15.06
Oregon	3,062	855	-41.38	58.84	7.19	15.06
Owens Valley	3,613	1,009	-19.38	36.84	5.21	17.03
Palm Springs	2,595	724	-35.94	53.40	8.04	14.20
Pisgah	4,509	1,259	-5.81	23.27	4.02	18.23
Riverside East	18,833	5,258	-5.49	22.95	5.06	17.19
Round Mountain-A	2,691	751	-30.31	47.77	3.37	18.87
Round Mountain-B	742	207	17.46	0.00	8.44	13.80
San Bernardino - Baker	8,707	2,431	1.23	16.23	6.74	15.50
San Bernardino - Lucerne	8,143	2,273	-2.25	19.71	7.67	14.57
San Diego North Central	739	206	-0.32	17.78	22.24	0.00
San Diego South	1,926	538	-12.29	29.75	5.50	16.74
Santa Barbara	1,180	329	1.07	16.39	9.16	13.08
Solano	2,865	800	-38.93	56.39	7.61	14.63
Tehachapi	29,473	8,228	-20.09	37.55	4.57	17.67
Twentynine Palms	4,616	1,289	-9.83	27.29	4.76	17.49
Victorville	4,271	1,192	-8.92	26.38	8.21	14.03
Totals	**213,885**	**59,710**				

The CPWG developed four CREZ energy metrics, or rating criteria, to incorporate different dimensions of renewable energy availability. These four criteria are:

1. **Criterion A**: Total CREZ energy potential (the **Total Energy** column in Table 3-3, and in criteria formulas below);
2. **Criterion B1:** Total CREZ energy weighted by CREZ adjusted economic scores (**Phase 2 Adj EconScore** in Table 3-3 and in criteria formulas below);
3. **Criterion B2:** Total CREZ energy weighted by CREZ adjusted environmental scores (**Phase 2 Adj EnviroScore** in Table 3-3 and in criteria formulas below);
4. **Criterion C:** CREZ energy having known commercial interest.

Economic scores on Table 3-3 represent CREZ renewable energy cost relative to the estimated cost of gas-fired generation. Higher values represent higher, less desirable costs, and the scores include negative values. In order to create an economic weighting factor, the economic scores were adjusted so that higher scores are more desirable and negative values are avoided. The *relative* adjusted scores for the CREZ are in the same order as the original scores, but are inverted. The ***adjusted*** economic scores shown in Table 3-3 are calculated from the original economic scores by subtracting the economic score for each CREZ from the maximum value for all CREZ.

Environmental scores on Table 3-3 represent relative environmental concern associated with development of the CREZ. There are no negative values, but higher scores are less desirable. To be able to be used in rating criteria formulas, CREZ environmental scores were adjusted to create scores in which higher values are more desirable. This was done by subtracting the environmental score for each CREZ from the maximum value for all CREZ. These are the ***adjusted*** environmental scores shown in Table 3-3.

The fourth energy metric is a measure of the amount of CREZ energy having known commercial interest. Power Purchase Agreements (PPAs) and requests to transmission authorities for interconnection to the grid (interconnection queue positions) are indications of commercial interest. Since the CAISO and POUs have different requirements for joining their respective interconnection queues, the CPWG developed alternative indications of commercial interest for CREZ in which these different requirements were at issue. The commercial energy metric used in the assessment sums the energy having PPAs and energy having queue positions for each CREZ.

3.3.3.4 Line Segment Energy Access Information

The renewable energy access provided by each line segment in the conceptual plan is estimated by multiplying the absolute values of the shift factors for the line by one of the four energy metrics for every CREZ and summing the result. These sums provide a numerical result for each of the four energy criteria. This is useful to compare the energy access provided by the line segment.

Criterion A – Total Energy Score

SegmentScore(j) = SUM [ShiftFactor(j,k) × TotalEnergy(k)]

In which:
SegmentScore(j) is the j^{th} line segment in the plan;
ShiftFactor(j,k) is the absolute value of the shift factor for segment(j) and CREZ(k);
TotalEnergy(k) is the total energy potential of CREZ(k)
SUM indicates that the results of the multiplications are to be added together.

Similarly:

Criterion B1 – Energy Weighted by Adjusted Economic Score

SegmentScore(j) = SUM [ShiftFactor(j,k) × TotalEnergy(k) × AdjEconScore(k)]

Criterion B2 – Energy Weighted by Adjusted Environmental Score

SegmentScore(j) = SUM [ShiftFactor(j,k) × TotalEnergy(k) × AdjEnviroScore(k)]

Criterion C – Energy of Commercial Interest Score

SegmentScore(j) = SUM [ShiftFactor(j,k) × CommIntEnergy(k)]

Since each of these metrics includes the shift factors, and three of the four include the CREZ energy, all four scores are highly correlated. In other words, the *relative* scores for line segments from any of the four metrics are similar. The four scores can thus be aggregated into a single "combined energy score" which provides a kind of average energy score for each line segment. Details of this combination process are included in the Online Supporting Materials, along with a chart showing the correlation of the four scores.

A short extract of the line segment scoring results is shown in Table 3-4 below. A complete list of these energy access scores for each line segment in the conceptual plan can be found in the Online Supporting Materials.

Table 3-4. Sample Line Segment Energy Access Results.

Segment ID	Total Energy Score(GWh)	Economic Energy Score	Environment Energy Score	Commercial Interest Score(GWh)	Combined Energy Score
INYK_KRAM_1	8,317	281,618	129,948	908	6,220
IRMT_SCEJ_1	8,691	191,667	145,956	4881	7,997
IRMT_SCEJ_2	8,691	191,667	145,956	4881	7,997
JULH_DESC_1	927	21,566	15,614	566	883

In this small sample, the combined energy score for each segment is less than the total energy score, due to the fact that there is a relatively small amount of energy having indications of commercial interest in the CREZ accessed. For the INYK_KRAM_1 line, for example, the commercial interest energy score (908 GWh) is a small fraction of the total energy score (8,317 GWh), making the combined energy score (6,220 GWh) much less than the total.

The **Combined Energy Score** combines CREZ energy, CREZ economics, CREZ environmental concerns and commercial interest into a single quantitative score for each segment, which can then be used for comparison purposes. Conceptual plan assessment results report the results of all four energy metrics as well as the combined energy score.

3.4 Limitations of the RETI Rating Methodology

In order to identify the minimum amount of transmission capacity sufficient to meet the state's 33% RPS goal by 2020, RETI had to estimate the usefulness of potential lines to access and transmit renewable energy. To do this, the CPWG developed a methodology based on shift factors, as discussed above. Understanding the significant limitations of this methodology is essential for understanding the usefulness of the conceptual plan itself. There are several categories of limitations:

- Shift factors provide only an approximation of how power would flow on the network, including the lines of interest. Shift factors provide no information about congestion, reactive power, or other crucial dynamics of how the system would respond to large amounts of power injected at CREZ. Shift factor calculations employ a linear process to model complex, non-linear dynamics. They cannot substitute for full power flow studies of potential transmission system additions.

A full explanation of the shift factor analysis and its technical limitations is included in Appendix J.

- Shift factors have been calculated based on LSE projected net short. Lines connecting CREZ that have relatively small energy output and lines serving small load centers will have smaller shift factors. From a statewide perspective, it is valuable to understand which lines carry the most renewable energy. This may be less helpful to smaller load centers intent on meeting renewable energy and greenhouse gas reduction goals.
- The RETI evaluation methodology is based on current estimates of CREZ energy potential, and these estimates are certain to change in the future. Discovery of larger amounts of low cost out-of-state resources, for example, could make import lines more cost-effective than they appear in shift factor-based ratings today.
- RETI assessments do not provide information needed for long-term benefit/cost analyses. Both the benefits and the costs of transmission projects must be evaluated over their 50^{+}year lives. The RETI plan, however, looks only to the year 2020. RETI has produced no estimate at all of the benefits that the lines identified might provide in reducing congestion, providing access to lower-cost generation or improving grid reliability; and it provides only a rough estimate of the initial capital cost of each group of projects. RETI cannot and does not make any judgment about the overall benefits and costs of any specific transmission line proposal.

Some RETI participants point out that the line segment rating scores developed by the CPWG methodology, based as they are on shift factor calculations, may be interpreted to imply a level of certainty about the relative usefulness of the lines that is not well supported by RETI analysis or data. Further caveats regarding the significance of assessment results are discussed in Section 3.8.

Many of the limitations of the RETI evaluation methodology are inherent in conceptual planning. Conceptual planning is a preliminary step in the transmission development process, and cannot substitute for full electrical or environmental feasibility studies. It is crucial to keep in mind that this initial conceptual plan is intended primarily to identify priority lines for detailed power flow study and production cost modeling.

3.5 Line Segment Groups

Line segments are conceptual electrical connections between substations. In this initial conceptual plan, the CPWG considered only those segments that form network

connections. Network connections are ones in which power flows in both directions on the line. Trunklines and other radial connections in which power flows predominantly in one direction (for example, from a generator to the grid) are not considered in the present analysis.

Individual transmission line segments function together with other network elements to collect energy and allow it to move throughout the system. The CPWG combined electrically-adjacent line segments into groups according to their primary function. The current plan identifies 14 groups, as described briefly below. Tables 3-5 and 3-6 relate the CREZ to the groups of line segments that provide access to them. Individual line segments belonging to each group are listed in Appendix F, and described in detail in Appendices G, H and I.

Renewable Foundation Group

The 14 line segments comprising the Foundation Group increase the capacity of the California transmission network between Palm Springs and Sacramento, which allows energy to flow north or south as needed. This capacity is likely to be essential to be able deliver renewable energy from any CREZ to consumers in all major load centers. The usefulness of the Foundation Group is not limited to renewable energy. The increased capacity the Foundation Group provides is likely to be needed to meet growing energy demand regardless of generation source. Maps showing Foundation Group lines are included below as Figures 3-2 (Southern California) and 3-3 (Central and Northern California).

Renewable Delivery Group

The Delivery Group provides additional capacity needed to move energy from the Foundation lines to major load centers. The increased capacity that this group provides is likely to be needed to meet growing energy demand regardless of generation source. Maps showing Delivery Group lines are included below as Figures 3-2 (Southern California) and 3-3 (Central and Northern California).

Tehachapi Group

Segments of the Tehachapi Group serve as Foundation and Delivery lines as well as providing access to the large wind and solar resources in the Tehachapi region. This group has been studied in detail by the California ISO and was approved by the CAISO in 2007. Segments 1-3 of the Tehachapi Group have already received Certificates of Public Convenience and Necessity (CPCN) from the CPUC and are under construction. Northern segments in the Tehachapi Group function primarily as Collector Lines

accessing wind and solar energy. Southern segments in this group function primarily as Renewable Delivery lines, transporting that power to the Los Angeles load center. Details of each of proposed segments 4-11 of this Group are described in Appendix G.

LEAPS Group

The transmission elements of this group have been studied in detail by the CAISO in connection with the proposed Lake Elsinore Advanced Pumped Storage project (LEAPS). RETI has not analyzed the merits of the LEAPS pumped storage component, which could be useful to increase system operational flexibility when large amounts of variable-output renewable energy generation are in service. Because the LEAPS transmission segments would increase transfer capacity between San Diego and the Los Angeles basin, they arguably could be included in the Foundation Group. In conjunction with the recently approved Sunrise Powerlink project, the LEAPS Group could provide an additional path between Los Angeles and San Diego for renewable resources in Imperial County; they could also allow renewable energy from the Riverside-San Bernardino areas to be delivered to San Diego. RETI has not yet compared the relative merit of the LEAPS Group to other options for providing access to Imperial resources. For want of a more precise way of categorizing LEAPS line segments, they are shown on the map in Figure 3-2 as Renewable Collector lines.

Renewable Collector Line Groups

The 10 remaining groups in the assessment serve primarily to collect energy from one or more CREZ and deliver this energy to a substation in the Foundation Group for distribution around the state. For example, the INYK_KRAM_1 segment is part of the Inyo Group which runs through the Owens Valley east of the Sierra. This segment delivers to the Kramer substation, a hub in the Foundation Group. The individual line segments in each Collector Line Group are listed in Appendix F.

Imperial Group

The Imperial Group is a network of collector line segments which provide access to renewable energy resources in Imperial County and deliver this energy to the Foundation lines at the Devers substations near Palm Springs and to the Sunrise Powerlink at the Imperial Valley substation near El Centro. Some line segments in this group proposed by Imperial Irrigation District (IID) have already been approved by the IID board. The Imperial Group as presently configured also includes a major line proposed by Southern California Edison which may or may not be redundant to the IID components, depending on the amount of renewable generation coming into service in Imperial County, southeast San Diego County and Baja California. RETI has not yet

completed its analysis of the relative merits of the IID and SCE segments of the Imperial Group to provide access to Imperial renewable energy resources. The inclusion of both projects in RETI Phase 2 analysis drives up both the environmental score and the investment cost of the Imperial Group.

BarrenRidge Group

The Barren Ridge Group is in advanced stages of development by Los Angeles Department of Water and Power (LADWP). This group provides access to the Tehachapi, Fairmont and Kramer CREZ, delivering renewable energy from these and other CREZ to LADWP customers. Some components of this group arguably could be assigned to the Delivery Group.

Inyo Group

Line segments of Inyo Group generally follow the Owens Valley east of the Sierra. They increase capacity on the SCE and LADWP systems to access renewable energy resources in the Central Nevada, Lone Pine, and Inyo CREZ, delivering that energy to the Foundation Group at the Kramer substation.

Carrizo Group

The Carrizo Group consists of two line segments in PG&E service territory which provide access to solar resources in eastern San Luis Obispo County and deliver energy to substations at Gates and Midway on Path 15. These resources are relatively small, but the required transmission upgrades are relatively simple and inexpensive to construct, and the Group environmental score is low, indicating relatively less environmental concern.

MtPass Group

The Mountain Pass Group, located in San Bernardino County, provides access to the Nevada, Mountain Pass, San Bernardino-Baker, Barstow, and Victorville CREZ, delivering this energy to the Lugo substation.

IronMt Group

The Iron Mountain Group provides access to the Iron Mountain and Needles CREZ, delivering energy to the Pisgah substation. The pace and extent of potential renewable development in these areas is uncertain, as resource development there may be substantially affected by the contemplated Mohave Desert National Monument. Given the uncertainty, RETI Phase 2 resource estimates for the Iron Mountain and Pisgah CREZ have not been changed from Phase 1 levels. In addition, potential conflicts with Metropolitan Water District (MWD) facilities may complicate access to the Iron Mountain CREZ. If such conflicts prohibit access from the south, the Iron Mountain Group would become a long “trunkline” rather than a network connection. This would

raise the cost of transmission access for generators seeking to connect in that area, and comparison with other transmission groups would be inappropriate.

Pisgah Group

At the present time, the Pisgah Group is configured as a renewable collector line providing access to the Pisgah and Lucerne Valley CREZ, delivering energy to the Foundation Group at the Mira Loma substation. As discussed above, resource estimates for the Pisgah CREZ may be affected by a potential National Monument. Moreover, SCE has announced its intention to modify the configuration of this group to include connections between Pisgah and Kramer substations. If so, the resulting Kramer-Pisgah-Mira Loma connection would likely move the Pisgah Group into the Foundation Group, because it would provide increased north/south transfer capacity. The results reported below are based on the current configuration and are expected to change in the Phase 2A Final Report.

Riverside Group

The Riverside Group now contains two potentially redundant projects. One is the California section of SCE's proposed Palo Verde-Devers Number 2 line (PVD2), and the other is a merchant transmission project called, "Green Energy Express." Both would collect energy from the Riverside East CREZ and deliver to the Foundation substation at Devers. The current assessment of the Riverside Group includes all line segments in both projects. This group will be reassessed with each of the two projects included separately, one at a time, so that the two can be compared and a more realistic assessment of the Group can be made. Potential conflict with MWD facilities, as mentioned in the Iron Mountain Group description above, may require re-configuration of some segments in the group.

Northeast Group

The Northeast Group is comprised of three line segments associated with the transmission project sponsored by the Transmission Authority of Northern California (TANC.) These segments provide access to the Round Mountain, Lassen and Northern Nevada CREZ, delivering the energy to a Foundation substation near Sacramento. As presently configured, the TANC project also includes a high capacity transmission line between Round Mountain and the Ravendale substation near the Lassen CREZ. The Ravendale substation has no other proposed connections to the grid in the current configuration. It is widely expected that further connections will be proposed, to connect Ravendale to the Sierra Pacific system and beyond. In its present configuration, however, the connection between Round Mountain and Ravendale is a "trunkline" in which power flows predominantly in one direction, from the CREZ to the grid, rather than a network

connection, in which power flows in both directions on the line. It has therefore not been included for analysis with the Northeast Group, as the current phase of RETI evaluation focuses only on network facilities.

North Group

The North Group is a proposed PG&E collector line that would reach from British Columbia to a Foundation substation at Tracy, between the Bay Area and Sacramento. The middle segment, between a planned Northeast Oregon (NEO) hub and a Collinsville, CA substation is proposed as a Direct Current (DC) segment. The value of this line to access renewable energy depends on estimates of cost-effective renewable resources in the Northwest, and potentially in other areas of the west. Black & Veatch used PG&E's estimates of near-term British Columbia biomass, geothermal, small hydro and wind resource potential in Phase 1, but excluded off-shore wind as unlikely to be cost-effective in the period to 2020. Phase 1 estimates of Out of State resource potential, including for British Columbia, will be re-assessed in future RETI work. PG&E plans to continue to explore commercial arrangements for renewable resources in Canada.

The capacity of this transmission project as proposed is much larger than the amount of British Columbia renewable resource potential found to be economic in Phase 1 investigation. Access to generation in other regions, which would utilize more of the capacity of the transmission project, and evaluation of potential regional benefits of the proposed line for load centers outside of California, is beyond the scope of RETI. Such benefits are likely to be important in the development of such a major interstate and international facility.

Maps of Line Segment Groups

Figure 3-2 below shows Renewable Foundation lines, Renewable Delivery lines and Renewable Collector lines in Southern California, along with CREZ and major existing transmission lines. **Figure 3-3** shows these categories of lines in Central and Northern California, also in relation to CREZ and major existing transmission. **Figure 3-4** below shows only Foundation lines in Southern California; **Figure 3-5** shows only Renewable Collector lines in Southern California. **Figure 3-6** shows only Renewable Collector lines, statewide.

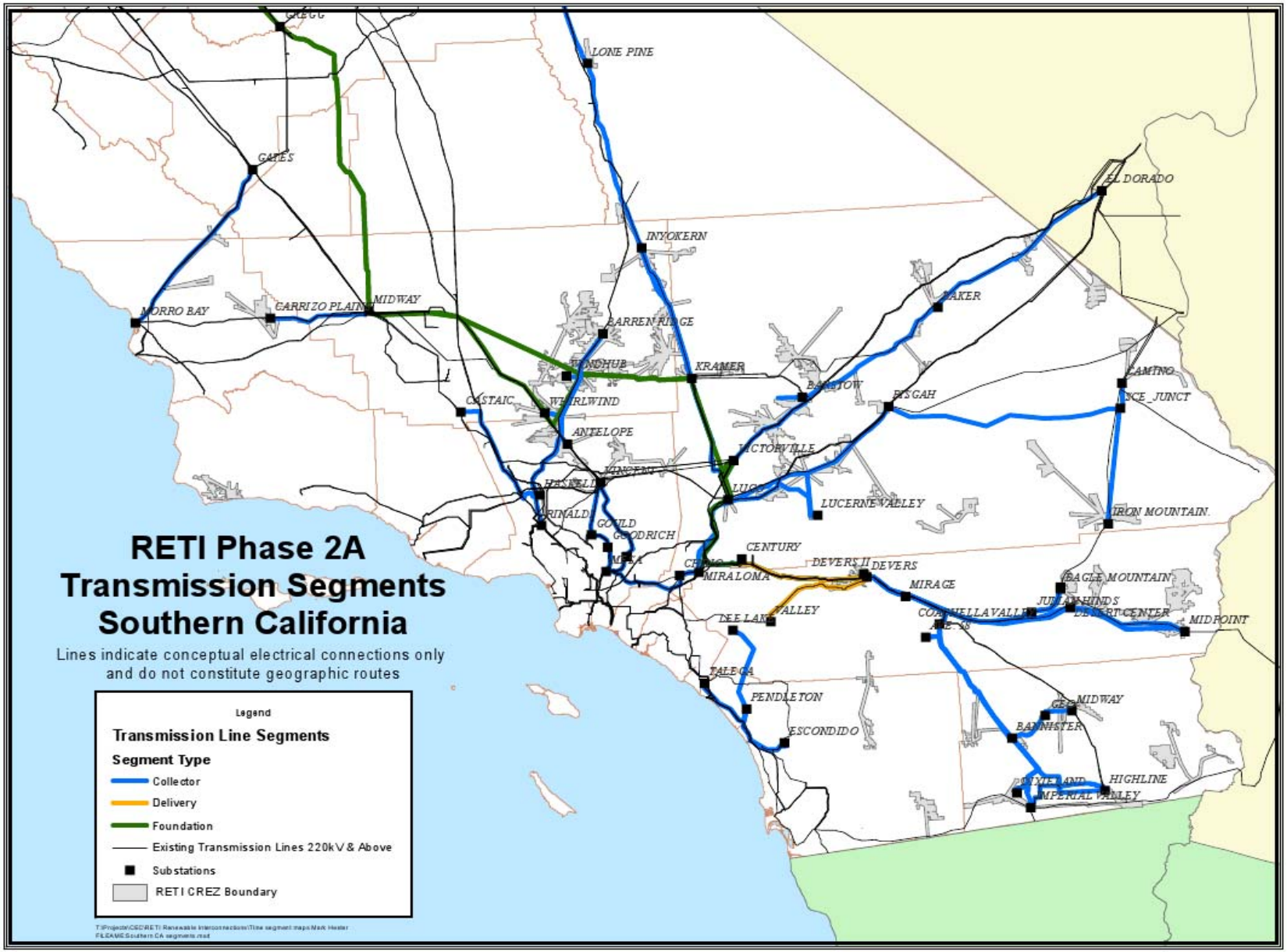

Figure 3-2. Map of Southern California Transmission Segments.

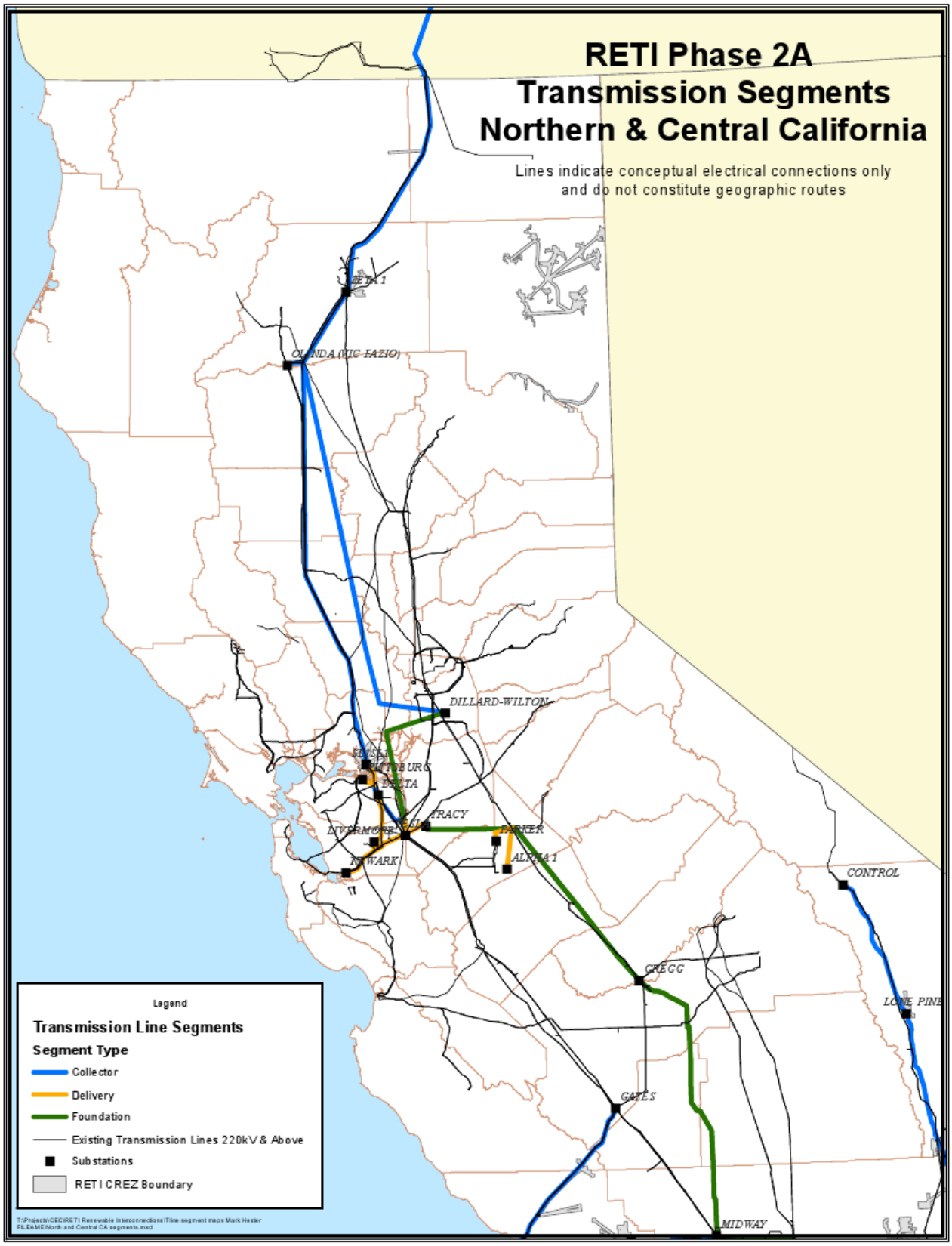

Figure 3-3. Map of Northern California Transmission Segments.

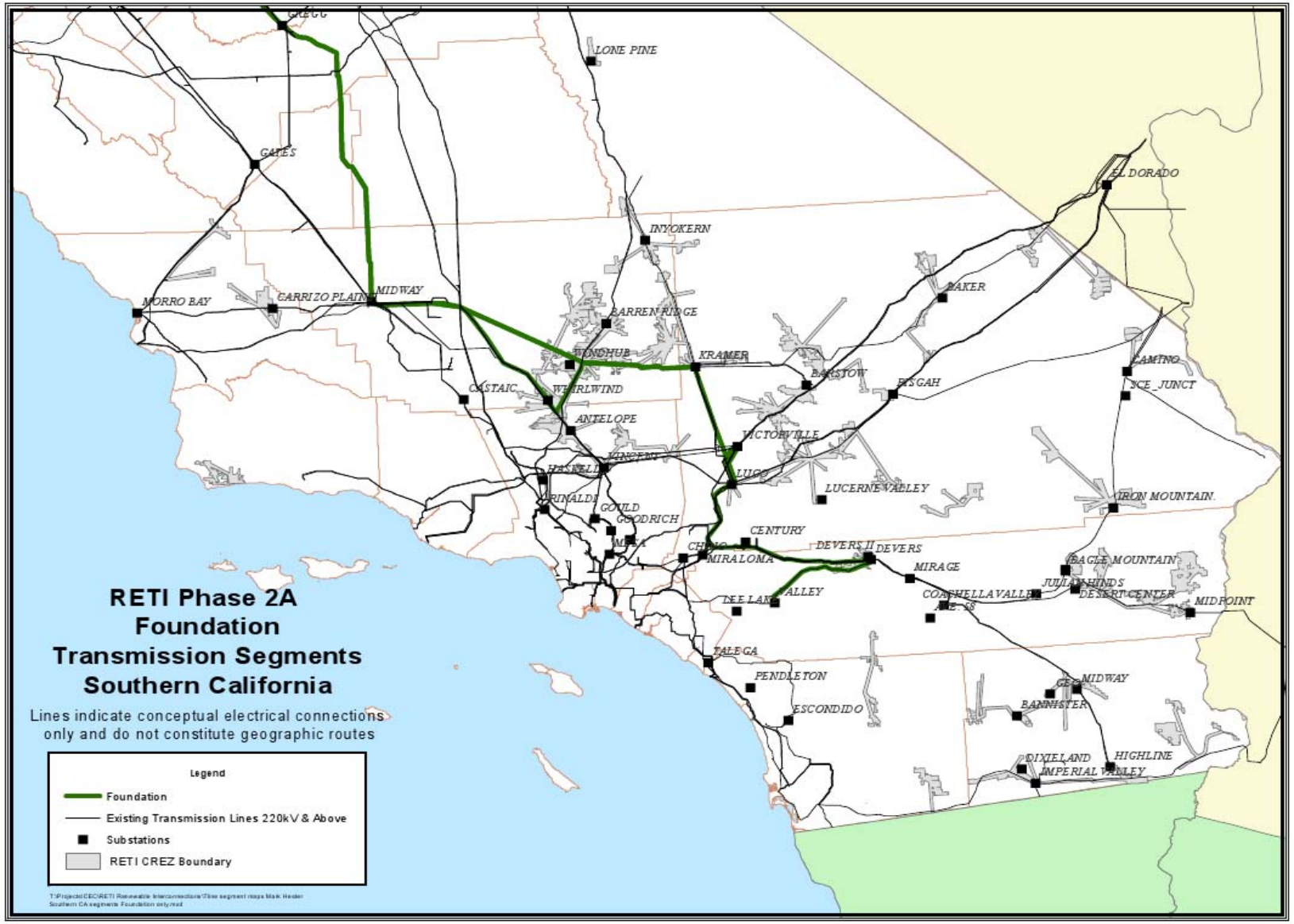

Figure 3-4. Map of Southern California Foundation Group Segments.

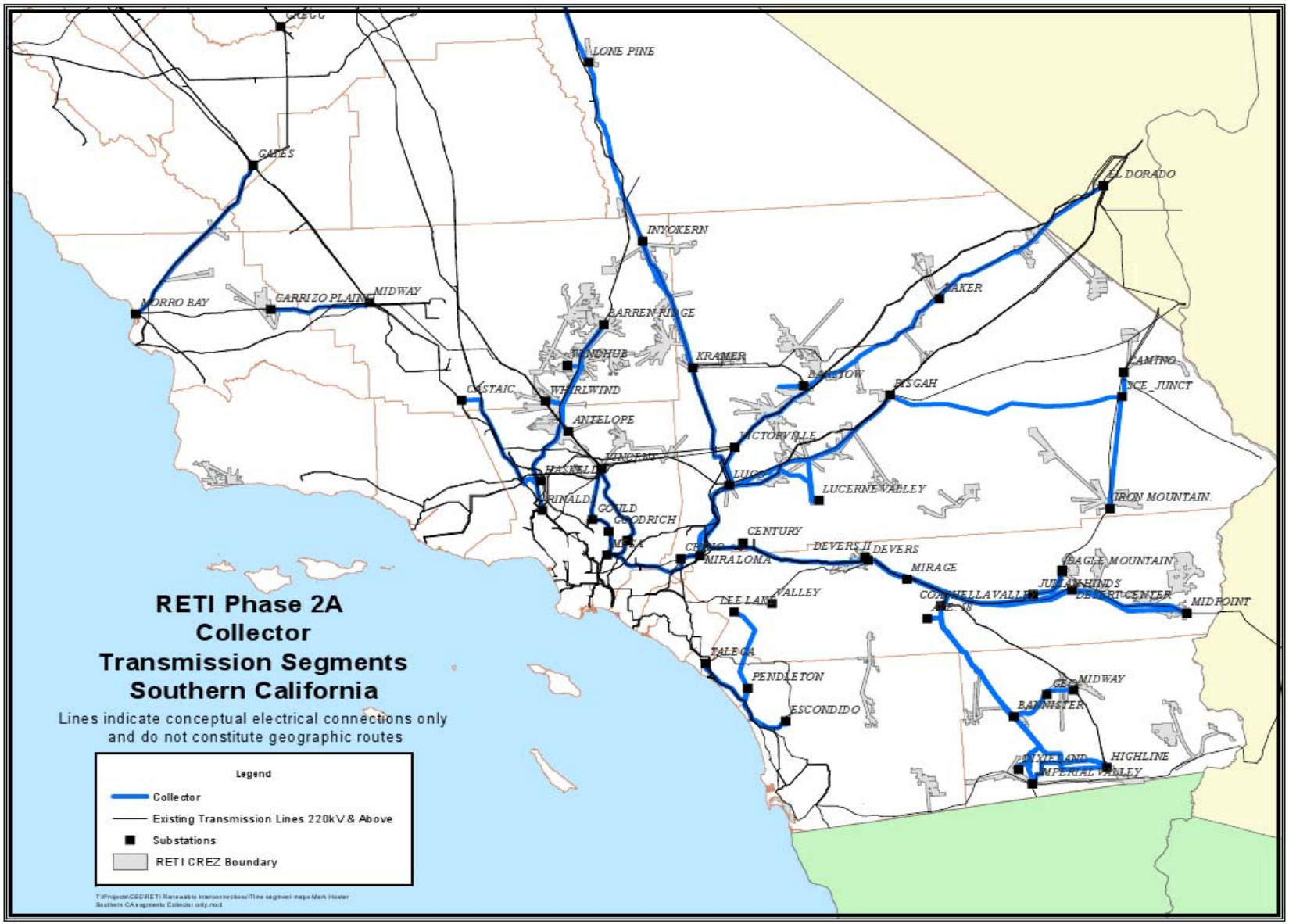

Figure 3-5. Map of Southern California Collector Group Segments.

Figure 3-6. Map of Collector Group Segments Statewide.

CREZ and Line Segment Groups

Table 3-5 and **Table 3-6** loosely relate CREZ to line segment Groups that provide access to them. All of the transmission lines considered in the Phase 2A conceptual plan are network facilities. Because the entire western grid is interconnected, some amount of power from each CREZ will flow on every line segment. The identified line segments, however, are critical for accessing large amounts of power from indicated CREZ.

Table 3-5. Collector Line Groups and CREZ Accessed.

Line Segment Group	CREZ Accessed
Tehachapi	Tehachapi, Fairmont
Imperial	Imperial North A&B; Imperial South; Imperial East; Baja
IronMt	Iron Mountain; Pisgah; Needles
BarrenRidge	Inyokern, Kramer, Tehachapi, Fairmont
Pisgah	Pisgah; Iron Mtn; SB Lucerne
MtPass	S. Nevada, Mtn Pass, Baker, Barstow, Victorville
Riverside	Riverside East; Palm Springs; 29 Palms
NorthEast	Round Mtn A&B; Lassen N&S; N. Nevada
Inyo	Central Nevada, Inyokern, Kramer
North	British Columbia, Oregon, Round Mtn
Carrizo	Carrizo North, Carrizo South, Cuyama

Table 3-6. CREZ and Collector Group(s) Providing Access.

CREZ	Line Segment Group Providing Access
Baja	Imperial
Barstow	Mountain Pass
British Columbia	North
Carrizo North	Carrizo
Carrizo South	Carrizo
Cuyama	Carrizo
Fairmont	Tehachapi
Imperial East	Imperial
Imperial North-A	Imperial
Imperial North-B	Imperial
Imperial South	Imperial
Inyokern	Inyo, Barren Ridge
Iron Mountain	Iron Mountain
Kramer	Foundation; Inyo
Lassen North	Northeast
Lassen South	Northeast
Mountain Pass	Mountain Pass
Needles	Iron Mountain; Pisgah
Nevada N	Northeast
Nevada C	Inyo; Northeast
Oregon	North; Northeast
Owens Valley	Inyo; Barren Ridge
Palm Springs	Riverside
Pisgah	Pisgah
Riverside East	Riverside
Round Mountain-A	Northeast; North
Round Mountain-B	Northeast; North
San Bernardino - Baker	Mountain Pass
San Bernardino - Lucerne	Pisgah
San Diego North Central	existing transmission
San Diego South	existing transmission
Santa Barbara	existing transmission
Solano	existing transmission
Tehachapi	Foundation; Tehachapi
Twentynine Palms	Riverside
Victorville	Mountain Pass

3.6 Line Segment Investment Costs

The capital investment required to build any segment or group of segments includes the cost of towers, wires, substations, transformers, other ancillary equipment located at the segment terminals, and the cost of Rights of Way (ROW). Transmission owner representatives on the CPWG first provided cost estimates for segments in their service territories. However, they have different cost structures, different costs of capital, and use different methods to estimate transmission development costs, and it became obvious that the line segment cost estimates were not comparable.

Further, land acquisition costs for ROW are notoriously difficult to estimate and vary widely depending on terrain, proximity to population centers and other factors. In addition, routes of many potential line segments have not been determined. For these reasons, the CPWG decided to exclude ROW costs from the line segment cost estimates in the Phase 2 evaluation methodology.

The cost estimates for all facilities in the conceptual plan have now been prepared using a single methodology for all facilities and a standardized set of component costs, regardless of owner. The cost estimates presented below have thus been prepared on a consistent and comparable basis. Because they are standardized, they may differ by large amounts from costs prepared by transmission owners for their proposed projects. Conceptual-stage costs are by definition preliminary and are subject to wide margins of error. The costs included in the assessment summary do, however, provide a rough estimate of the relative investment required of the RETI transmission groups.

The CPWG's initial evaluation criteria formulas divided each of four energy-related factors for each line segment by the capital cost of that line segment. This produced a benefit/cost metric equal to renewable energy access per dollar of investment. Despite having now used standardized numbers to estimate line segment costs, CPWG members think current cost estimates are too uncertain to use in the RETI evaluation methodology. As a result, the CPWG decided to keep energy access factors and cost estimates separate, and to report both instead of combining them.

3.7 Evaluation of Line Segment Environmental Concerns

A major goal of the RETI conceptual planning process is to anticipate environmental concerns and to be able to compare the environmental attributes of various transmission options. The CRWG developed a rating system specifically for this purpose. This system incorporates both objective scores and expert judgment.

Some of the factors determining the level of environmental concern associated with a new line segment can be readily identified. Is new right of way required, or is the new line being placed on existing towers with no right of way expansion? Is the new line parallel to an existing line or does it go off in a new direction? Has the corridor in which the line is place been previously identified as a transmission corridor or not? The formula developed by the CRWG provides an objective way of assigning a quantitative value to features of concern such as line length, location, and type of construction.

Many essential environmental concerns which may make it difficult or impossible to permit a line cannot, however, be not captured in a quantitative formula. Reluctantly departing from RETI's commitment to complete objectivity, the CRWG impaneled two groups of environmental experts, one for Southern California and one for Northern California, to provide an overall environmental rating for each line segment in the plan using their professional judgment. Using a lengthy checklist of potential issues, the experts assigned overall value of 1, 2, or 3 to indicate low, medium or high levels of concern respectively:

1. Low levels of concern and/or potential impacts relatively easy to mitigate;
2. Medium levels of concern and/or some difficulty expected with mitigation;
3. High levels of concern and/or difficulty identifying adequate mitigation.

Each of these panels met separately to review the segments within their respective regions. The meetings were conducted via WebEx to enable all experts to participate[16] and to allow interested members of the SSC, the EWG and the public to observe. Only panel members participated in scoring discussions and decisions. The issues checklist and environmental scores for each line segment are included in the online supporting materials referenced in Appendix D. Participants on the expert panel are listed in Appendix E. An example of a completed checklist is presented in **Figure 3-7** below.

	A	B	C	D	E	F	G	H	I	J	K
1		RMT_SCEJ_2	SCEJ_CAMI_1	SCEJ_PISG_1	SCEJ_PISG_2	MTPS_BARS_1	BARS_LUGG_1	PISG_LUCV_1	LUCV_LUGG_1	PISG_MRA_1	CONT_UPN_1
2	Environmental Concerns Checklis	11	12	13	14	15	16	17	18	19	20
3	Segment length in miles	39	22	78	78	109	52	53	24	118	60
4	Category One Lands (some limited tx may be allowed)										
5	Designated Federal Wilderness Areas/Wilderness Study Areas (BLM)										
6	National Park Service Units (including Mojave Preserve)										
7	National Wildlife Refuges										
8	Inventoried Roadless Areas (USFS)										
9	BLM Natl. Recreation Areas/Natl. Monuments/Natl. Conservation Areas										
10	National Historic and/or Scenic Trails/National Wild, Scenic and/or Recreational Rivers										
11	Lands in Pending Wilderness Bills										
12	HCP and NCCP Hard Reserves										
13	State Wildlife Areas and Ecological Reserves (DFG)/California State Wetlands										
14	State Parks/State Wilderness Areas										
15	Wildlands Conservancy and Other Private Preserves										
16	Research Natural Areas (RNA) or Special Interest Areas (SIA)										
17	Category Two Lands (limited tx)										
18	BLM Areas of Critical Environmental Concern (ACEC)										
19	Designated Critical Habitat T&E Species	X	X			X	X	X	X	X	
20	Desert Wildlife Management Areas (DWMA)	X	X			X	X				
21	Mojave Ground Squirrel Conservation Areas (MGSCA)						X				
22	Wildlands Conservancy acquisitions under BLM ownership	X	X	X	X						
23	Proposed and Potential Conservation Reserves in HCPs and NCCPs										
24	Conservation Easements										
25	Other Environmental Concerns										
26	Identified cultural resources	X				X					
27	Visual resources			X	X	X					X
28	Williamson Act										
29	Other important wildlife habitat			X	X		X	X	X	X	
30	Citizen-proposed wilderness areas										
31	Proposed Mother Road National Monument		X	X	X						
32		X									
33	Other Relevant Information (e.g., line size)										
34											
35											
36	ROW/Corridor Information										
37	Segment/Section Length										
38	1 ROW no change	X	X								X
39	2 ROW expansion					X					
40	3 New ROW in designated corridor			X	X		X		X	X	
41	6 New ROW co-located but NOT in a designated corridor.							X			
42	10 New ROW not colocated and NOT in a designated corridor										
43	1 Upgrade/no footprint change										
44	2 Rebuild/footprint changes	X	X								X
45	4 New line			X	X	X	X	X	X	X	
46											
47											
48	Environmental Concern (Low, Medium or High)	H	H	H	H	M	H	H	H	H	L
49											
50											
51											
52											
53											

Cell: B33
Comment: rjohnson:
Existing row goes through proposed Mojave Desert National Monument
Cell: C33
Comment: rjohnson:
Existing row goes through proposed Mojave Desert National Monument
Cell: G33
Comment: rjohnson:
Desert tortoise and fly catcher critical habitat and riparian concerns
Cell: H33
Comment: rjohnson:
need to avoid category 1 and 2 areas - need to see better maps
Cell: I33
Comment: rjohnson:
need clarification on the designated corridor between lucerne and lugo
Cell: J33
Comment: rjohnson:
Section 1 is medium with high concern unless critical habitat and mitigation banks can be avoided in the Cajon Pass
Section 2 is on open position of new towers??

Figure 3-7. Environmental Issues Checklist for Transmission Line Evaluation.

To obtain an overall environmental score for each segment, the subjective rating score produced by the expert panel was multiplied by the objective measures of ROW characteristics, line length and construction category, as shown in the formula for Criterion D below:

Criterion D –Environmental Concern

Environmental Score =
EnvFactor × LenVal × ROW_Val ×CharVal

Where:
EnvFactor = Value assigned for each type of right of way associated with the line segment assigned by expert panel.
LenVal = Value assigned to section according to segment length.
ROW_Val = Value assigned to the segment's right of way category.
CharVal = Value assigned to the segment's construction category.

To calculate ROW values for this formula, the CRWG developed the following methodology: a segment that was in an existing ROW was given a score of 1; a segment in an existing ROW that would require expansion of that ROW was given a score of 2; a segment that would require a new ROW in a designated corridor was given a score of 3; a segment that would require a new ROW not in a designated corridor but could be co-located with another line was given a score of 6 and a segment that would require a new ROW that was neither co-located nor in a designated corridor was given a score of 10. To calculate the value assigned to the segment's construction category, the group assigned a score of 1 to an upgrade that would not change the existing footprint; a score of 2 to a rebuild that would change the existing footprint and a score of 4 to a new line.[17]

A few of the proposed line segments are comprised of sections having different characteristics. For these segments, a score for each section is computed using the above formula and the scores are combined based on relative length.

3.8 Group Assessment Results

Scores for any group are obtained from the scores of the line segments in the group by simple summation. Summation is appropriate for group investment cost and environmental scores, but is problematic when applied to group energy access scores obtained from shift factors. For example, two line segments in series (e.g. ZETA1_OLND_1 and OLND_DILL_1) may carry the same energy but do not provide twice the access to renewable energy. Adding the

[17] See lines 37 to 45 on Figure 3-7, Environmental Issues Checklist for Transmission Line Evaluations.

energy scores of the two segments to obtain an energy score for the group overstates the energy access provided by the group. Simple summation of segment energy scores is perhaps the most significant weakness of the conceptual plan assessment, and, the CPWG is investigating a more complex methodology for combining segment energy scores into group scores.

An Excel spreadsheet table with complete assessment results for the groups using the summation methodology is available as Online Supporting Material. This table can be sorted on any of the criteria results used in the assessment to identify which groups have the highest scores in for any criterion category. Summary energy, environmental, and cost results using the current assessment methodology for the 14 transmission groups are shown in Table 3-7, sorted on combined energy score.

Table 3-7. Transmission Group Energy, Environmental and Cost Summary.

Group Name	CREZ Energy (GWh)	CREZ Econ Score	CREZ Enviro Score	CREZ CommInt (GWh)	Combined CREZ Energy (GWh)	Group Enviro Score	Group Cost ($Million)
Foundation	51,190	1,515,622	812,237	130,424	52,759	1119	$3,481
Tehachapi	27,838	864,591	455,880	84,221	30,947	97	$728
Imperial	21,819	663,634	358,435	52,045	22,219	837	$1,311
Delivery	12,308	377,683	197,609	32,482	12,945	739	$1,075
IronMt	11,960	258,344	195,551	24,061	10,928	131	$832
Riverside	9,134	224,815	152,990	19,881	8,756	419	$1,081
Pisgah	8,473	196,096	133,922	21,602	8,411	396	$588
MtPass	7,730	173,215	123,731	14,229	6,885	252	$798
NorthEast	3,782	102,595	54,507	18,647	5,055	600	$735
LEAPS	4,625	131,975	73,114	11,912	4,753	246	$162
BarrenRidge	3,800	133,489	64,867	13,454	4,618	77	$208
North	3,410	135,942	52,773	7,495	3,536	401	$3,898
Inyo	3,686	127,854	59,346	2,031	2,880	88	$656
Carrizo	2,600	52,692	39,904	5,391	2,351	20	$78
Median Value	**8,102**	**184,655**	**128,827**	**19,264**	**7,648**	**324**	**$766**

Table 3-8 shows the combined energy score, environmental score, and cost associated with each transmission group, with each column sorted separately.

Table 3-8. Group Combined Energy, Environmental Score and Cost, Sorted.

Collector Lines

Group	Group Combined CREZ Energy (GWh)	Group	Group Enviro Score	Group	Group Cost ($Million)
Tehachapi	30,947	Carrizo	20	Carrizo	$78
Imperial	22,219	BarrenRidge	77	LEAPS	$162
IronMt	10,928	Inyo	88	BarrenRidge	$208
Riverside	8,756	Tehachapi	97	Pisgah	$588
Pisgah	8,411	IronMt	131	Inyo	$656
MtPass	6,885	LEAPS	246	Tehachapi	$728
NorthEast	5,055	MtPass	252	NorthEast	$735
LEAPS	4,753	Pisgah	396	MtPass	$798
BarrenRidge	4,618	North	401	IronMt	$832
North	3,536	Riverside	419	Riverside	$1,081
Inyo	2,880	NorthEast	600	Imperial	$1,311
Carrizo	2,351	Imperial	837	North	$3,898
Median	**5,970**	**Median**	**249**	**Median**	**$731**

Foundation & Delivery Lines

	Group Combined CREZ Energy (GWh)	Group Enviro Score	Group Cost ($Million)
Foundation	52759	1119	$3,481
Delivery	12945	739	$1,075

These numerical results are based on the best data available and the compositions of each transmission group. They are subject to change as data is updated, line segments are added or subtracted from the conceptual plan, or improvements in the rating methodology are made.

These scores have meaning only in relation to one another. The value of any single score has no significance. It should be noted that the sum of the combined energy scores is over 177,000 GWh, about three times the estimated net short. This result is an artifact of the methodology and in no way indicates the amount of new transmission capacity available on the identified potential line segments.

Evaluation results for the transmission Groups are presented graphically in **Figure 3-8** and **Figure 3-9**. Notes to the bubble chart in Figure 3-8 are included below the chart. As in the bubble chart comparing relative CREZ rankings (Figure 2-4), lower environmental scores in Figure 3-8 indicate less environmental concern.

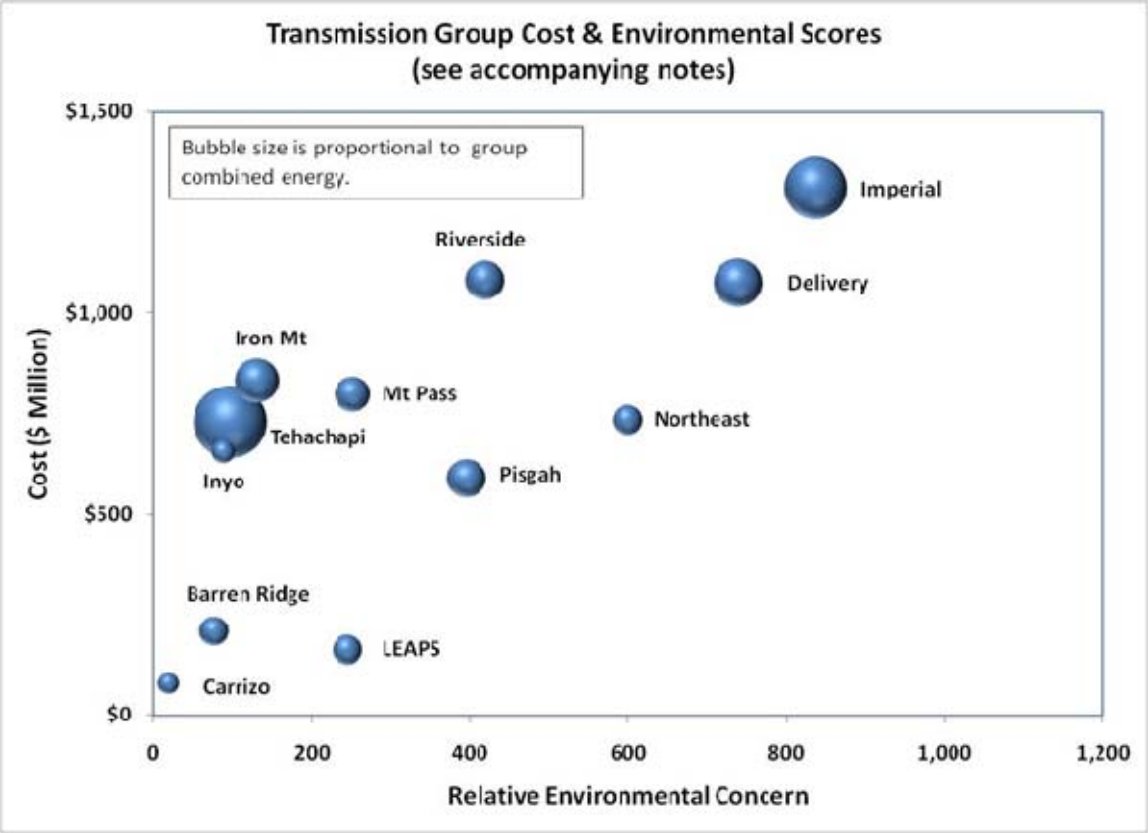

Figure 3-8. Transmission Group Cost, Environmental Scores and Group Combined Energy, Bubble Chart.

Notes
Areas of bubbles are proportional to Group combined energy.
Imperial and Riverside Groups are known to contain duplicative line segments which artificially increase environmental scores and costs. Duplicative segments will be removed in the final Phase 2A report.
Foundation Group is off the top of the chart. Combined energy = 52,780 GWh Environmental score = 1,119 Estimated cost = $3,481 Million
North Group is off the top of the chart since its cost includes all proposed line segments whose capacity is much greater than needed to access estimated CREZ energy. Combined energy = 3,596 GWh Environmental score = 401 Estimated Cost = $3

Figure 3-9 presents the same information contained on the bubble chart in Figure 3-8, as a bar chart.

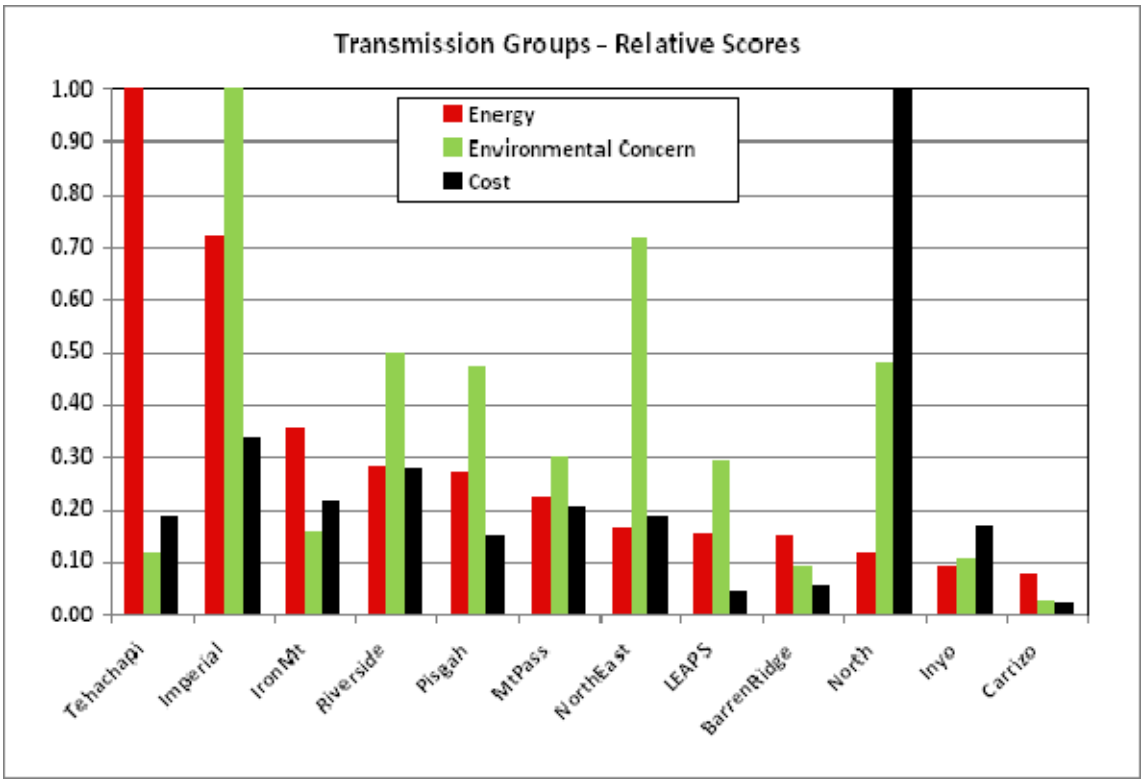

Figure 3-9. Transmission Group Cost, Environmental Scores and Group Combined Energy, Bar Chart.

Notes to Figure 3-9:
Values for each bar have been converted from direct assessment results and are relative to maximum value in each category.
Bigger energy bars are more desirable.
Bigger cost and environmental concern bars are less desirable.
In order to produce bars of comparable sizes, assessment results had to be translated into a common format. In this case, the values for each category represent the value for each group relative to the maximum value for each group. The groups have been ordered on relative energy values.
In general, environmental scores and costs would be expected to be more or less proportional to energy. Green or black bars higher than the red bar indicate that the group has higher costs or environmental concerns than might be expected. Green or black bars lower than the red bar indicate that environmental concerns are lower than might be expected.

Inherent uncertainty in the data necessarily creates uncertainty in the results, and conclusions should be qualified accordingly. Although it has not been possible to estimate the

amount of uncertainty in these results, a difference of a few percent between two scores in the same category is almost certainly not significant. Moreover, since groups serve different functions, comparisons between all groups are not appropriate. A group with a low combined energy score can be expected to be a valuable addition if it also has low cost and a high environmental rating score. It is inappropriate to use individual results out of context.

3.9 Recommendations for Study and Development of Line Groups

Recommendations for the study and phased development of each Group of transmission line segments, based on the energy access, environmental concern, investment cost and timing information presented in this Phase 2A Draft Report are now being prepared and will be presented in the Phase 2A Final Report.

3.10 Policy Recommendations

To support expedited approval and development of the transmission required to enable California to meet its policy goals, the RETI SSC recommends that:

1. The CAISO and POUs study Renewable Foundation lines and Renewable Delivery lines as soon as possible to determine which are needed, and when they should be placed in service to meet state goals by 2020.
2. In order to avoid duplicative or redundant facilities, California planning authorities work closely with one another to identify, propose, study and approve joint IOU-POU projects, and eliminate barriers to joint use of such facilities.
3. Multiple transmission charges be eliminated for purposes of all transmission line segments built primarily to access and deliver renewable energy in California, so that all transmission customers buying renewable energy sourced from California CREZ pay only one transmission charge. On joint IOU-POU transmission lines, for example, IOU customers would pay only the CAISO transmission charge, and POU customers would pay only a POU transmission charge; in neither case would a customer pay both CAISO and POU transmission charges.
4. The California Energy Commission should begin immediately, per Public Resources Code §25331, to designate additional appropriate corridors, beyond those already established by federal agencies or utilities' rights of way, to reserve and protect transmission access to areas where renewable energy development is likely to occur, including likely routes for Renewable Foundation lines and Renewable Delivery lines. Corridor designation must be coordinated among state and federal agencies and support

access to, for example, BLM Solar Energy Zones, and Desert Renewable Energy Conservation Plan (DRECP) generation development areas, as well as to the most likely CREZ.